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Aluminum at Arvida

AT ARVIDA, on the River Saguenay, in Quebec, a plant is being built for the manufacture of aluminum by the Aluminum Corporation of Canada, a subsidiary of the Aluminum Company of America. This subsidiary has taken over all the assets of the Northern Aluminum Co., Ltd., the American company's old subsidiary in the Dominion to the north. "Arvida," be it known, stands for Arthur Vining Davis, president of the parent corporation. It is situated at Chute à Caron—Charon's Falls—the lower of the two great power sites on the Saguenay, which figured in the transaction last year between James B. Duke and the Aluminum company, just a short while before the former's death. The other site is at Ile Maligne, farther up the river and nearer Lake St. John. If the Aluminum company acquired an interest in this upper site as well, information to that effect has not been divulged.

Never has the supply of aluminum been sufficient to meet market needs, it is asserted. Not that there is any scarcity of bauxite, for it has been estimated that the Aluminum Company of America has far more than is needed to maintain production at the present rate for over a century to come. Nor has it been particularly a matter of power, although great quantities of this are called for; nor a question of sufficient capital. Rather it is because the actual time required to erect the necessary plants is so great that before they are completed the demand has increased beyond the limits of the new capacity. At Arvida a great plant is projected. Here alone 800,000 hp. can and will be developed, it is said—a colossal amount of power. To erect this plant about three years will be required—that is, three years to build the dam and its foundations and other structures. This means that it will not be ready before the end of 1928. The first two years will be consumed in construction work alone, and in the last year construction and equipping will proceed together.

But production of aluminum at Arvida is not to be delayed so long. Before his death, Duke and his Price associates had built at the upper site at Ile Maligne a power plant that ultimately will develop 540,000 hp. and which now is actually making 360,000 hp., of which 100,000 has been leased to the Aluminum company for consumption at Arvida. Here transformers and converters are being installed and the production of the metal is expected to be begun this spring. If the entire 100,000 hp. leased be used for this specific purpose, this plant will be able to produce 20,000 tons of metal a year. Should the leasing of this power be continued after 1928, by which time the large 800,000 hp. plant will be available, then at Arvida the Aluminum company will have fully 900,000 hp. available, or enough to make 180,000 tons of aluminum annually, as estimated ordinarily, and to meet auxiliary demands, if the power all be utilized for this purpose. The world production at present is 200,000 tons or thereabouts per annum. Thus, with 800,000 to 900,000 hp. available for making aluminum, to say nothing of the possibility of obtaining more power from the upper site at Ile Maligne, the Aluminum company will be able to take care of a greatly increased demand for metal by the end of 1928.

Reserves of high-grade bauxite suitable for making aluminum by the process used at present, as has been stated, are ample. Besides these reserves are still larger quantities of bauxite of too poor a quality for present uses. Silica and iron are the impurities most objectionable in the process used. Recently, however, in Sweden, the so-called Haglund process has been developed, by which alumina—the oxide—can be made from bauxite directly in the electric furnace, and which actually utilizes the iron and silica in the ore by making ferrosilicon as a byproduct. Thus ores containing what is now considered objectionable amounts of these impurities may be made commercial by this process. A step further in the development of the process, it is said, may make it possible to produce aluminum directly in the electric furnace.

Savings by Improved Flotation Work

OUR DEFINITION announced last week will explain why the description of Cananea practice on another page of this issue is entitled "Differential Flotation." Savings that have been made at this plant through improved methods of flotation are phenomenal, and yet they are no less important than those made at some other plants. Depressing the iron and throwing it into the tailing has changed the grade of concentrate from between 4 and 5 per cent to between 19 and 20, making the ratio of concentration about 11 to 1 instead of 2½ to 1. And yet the concentrator recovery, instead of being reduced, as might be expected, with the higher grade of concentrate, has actually increased from about 86 to a maximum of 94 per cent. Nor is this all. The amount of material to be smelted, per unit of copper produced, became only about one-fifth of what it was. So all the blast furnaces were shut down, then all the roasting furnaces, so that it is now necessary to operate only two reverberatories and two converters. Stack losses were so largely reduced that the smelter recovery increased from 90 to 97 per cent. Labor, of course, is also largely reduced, including that in the machine shop, the electric shop, and the iron foundry. Thus has a veritable metallurgical revolution been effected, all in a few months.

What is to come next? Perhaps it will be to save the iron instead of throwing it away with the gangue. This is what W. F. Lamoreaux is planning to do at Ducktown, Tenn. The iron there, however, is in the form of pyrrhotite. It will be floated after the copper, the concentrate roasted in Herreshoff furnaces, the gases used for acid making, and the calcine sintered,

making an iron sinter containing 68 per cent iron. This leaves nothing thrown away but the gangue minerals, which may be considered poor metallurgy in 2026, but is pretty near the metallurgists' ideal now.

Facts About Prospects

NOT ONLY the Southern Pacific and the Canadian Pacific companies are rendering service to mineral claim owners along their rights-of-way by publishing descriptive lists of claims for sale, as mentioned in an earlier editorial, but the Union Pacific also is pursuing a similar policy, an admirer of the last-named railroad system declares. Such service is of benefit to both prospective buyer and seller and in the long run to the railroad. Now comes word that the U. S. Bureau of Mines may establish a clearing house of information regarding foreign prospects to prevent needless waste of money and time in examining the same property again and again. In the absence of such an agency, owners of certain prospects abroad have seemingly had little difficulty in interesting capital in the United States sufficiently to send an engineer to look the properties over, in spite of the fact that other engineers had previously turned them down. With such a service established by the Bureau, a mining company would first attempt to find out whether a property had been previously examined, and how often, before it undertook to make its own examination.

The railroads previously mentioned might take a leaf from the government's book and improve their service by including in the data filed information as to whether a claim had ever been examined and by whom. No such pertinent question is asked in the Union Pacific questionnaire, for example. It may be argued against this that the knowledge that a property had been examined without a sale resulting might influence an engineer making a subsequent examination, irrespective of the merits of the property. The search for new mines is too keen today, however, to give much credence to this point. It is certain that the prospective buyer will welcome the additional information.

American Prosperity From the English Viewpoint

TWO young Englishmen, Bertram Austin and W. Francis Lloyd, have recently written a book entitled "The Secret of High Wages," and their ideas on Britain's industrial troubles have been revealed further in an article in *The Observer*, summarized in the *New York Times* of March 21. Nine reasons are given for America's great prosperity, as follows:

1. Promotion in America is by merit.
2. America sticks to the principle of small profits and quick returns, and wealth is made by fine margins of profit on immense and rapid turnover.
3. Rapid turnover is secured by simplification and cheapening of processes, which necessitates less capital for a given output.
4. America shows endless keenness in devising time-saving and trouble-saving appliances.
5. The American employer is not hostile to high wages.
6. American manufacturers co-operate by exchanging ideas.
7. Americans are vigilant and acute in eliminating waste, and in conserving time, energy, and space.
8. American welfare methods double high wages in their stimulative effect by surrounding the workers with cleanliness and light, and by seeking in every way to increase their convenience and satisfaction.
9. Americans encourage research with magnificent intelligence, scouring the world to obtain the best research brains.

This statement of reasons for American prosperity is as interesting for what is not said as for what is said. Immense natural resources are not mentioned; nor is anything said about the high protective tariff; nor about "prohibition." Practically every reason offered has to do with the personality of the American alone; with the American temperament rather than with something more concrete. Therefore if the reasons stated are the all-important ones, it would seem that foreign countries would have difficulty in duplicating this prosperity, for man's nature is difficult to change.

The first reason seems well founded. Few men are retained in American industry because they are merely old employees or because of their family or social connections. They must deliver the goods. Travelers often notice the absence of old, inactive men in the ranks of American executives. The third reason is generally admitted. Perhaps nowhere else in the world is the value of the scrap heap appreciated as in America; not, of course, for what may be found on it but for what may be placed on it. New machinery of a more efficient type is constantly being purchased to displace old that may still be as good as it ever was. The fourth reason offered is a corollary of the third. The philosophy of the fifth has been well brought out in that absorbing book, the autobiography of Henry Ford. High wages are paid to get the best men, and only if the wage-earner will work enough harder to earn them. The American wage-earner has shown a willingness to do this.

The sixth reason is worth more than passing mention —"American manufacturers co-operate by exchanging ideas." In fact, these English writers say that "the most essential step" for the British to take, to duplicate American prosperity in Britain, "is the breaking down of traditions of secrecy in business matters. . . . Exchange of trade information between competitors is essential if the full harvest of improved technical knowledge is to be reaped. Such a policy is largely practiced in America, not for altruistic reasons, but because it has been found to pay." Mining engineers, particularly, will be impressed with the force of this statement. Interchange of technical information and the free publication of technical data are almost universal among the mining and metallurgical companies of this country, though exceptions must be made, as in the aluminum industry, which is a monopoly, and in the zinc metallurgical industry, which is generally considered decidedly backward for this very reason, though signs of improvement have recently been observed. Certainly the copper industry in America owes much of its preeminence to its absolute openness. And in the chemical engineering field, the rubber industry should be cited. Using an imported raw material, and operating in a country of high prices, the rubber industry exported over $50,000,000 worth of its products last year. A few years ago, when the rubber companies were comparatively small struggling concerns, there was no interchange of technical information and any strange em-

ployee was looked on with the utmost suspicion. Today there is free co-operation and admittance of visitors in this most competitive of industries. All have gained, and at whose expense? Why, at the expense of the foreign competitor, with his closely guarded out-of-date "secrets."

Mining vs. Manufacturing

COPPER PRODUCERS have been told on various occasions that their salvation lay in expanding their activities so as to include manufacturing of finished products. Therein, it is said, reside the big profits. That this contention is not unsound apparently has been proved by Anaconda; and corroborative evidence may be adduced by citing the New Jersey Zinc Co., the Aluminum Company of America, the International Nickel Co., and the U. S. Steel Corporation. All of these dig ores and sell manufactured products to the ultimate consumer, or at least to a customer well toward the end of the chain of buying groups; and all are enjoying reasonable prosperity.

Likewise, the National Lead Co. has been mentioned as an example. Accordingly, the comment of E. J. Cornish, president of that company, in the annual report just issued, is particularly interesting. Of white lead in oil, one of the company's most important products, the sales in 1925 were 18.1 per cent less than in 1924 and 20.9 per cent less than the average for the last four years. He attributes this decline to the high price of pig lead and the increased consumption of cheaper competitive pigments. Mr. Cornish says that the manufacturing capacity for both white lead and the oxides of lead has increased beyond the requirements for consumption, with the result that competitive conditions are becoming more and more severe; and that the margin of profit accordingly is reduced. But he says *"the resulting decrease in profits has been more than made up by the exceptionally large profits in our mines."* He does not say that the white-lead business was unprofitable; and, on the other hand, the profits of lead mines were probably abnormally high in 1925. Nevertheless, the statement provokes thought.

Suppose that through some combination of circumstances the productive capacity of the copper and brass fabricating plants in the United States should become considerably greater than the demand for products. It is likely that "competitive conditions would become more and more severe and the margin of profit correspondingly reduced," as happened in the case of lead pigments. Or, if by some miracle the copper mines of Chile and Peru should be wiped off the map, it is not improbable that consumption of copper and possible world production would so nearly coincide that the copper-mining industry, by and large, would be as profitable as lead mining has been during 1925. It is conceivable, then, that Anaconda's copper mines would far eclipse its manufacturing plants as money makers, for the time being at least.

Manufacturing profits, in proportion to the capital investment involved, are subject to definite limitations; but there are no comparable limitations with mining. This follows from a logical course of reasoning: If one manufacturer can make copper boilers for $5, it is reasonable to believe that any number of others can do nearly as well. Accordingly, no matter what the demand, the profit to any manufacturer cannot be more than, say, $1 per boiler. But because a company with a large, rich, or otherwise favorably circumstanced mine can produce refined copper for 5c. per pound, it does not follow that owners of other mines can do approximately the same thing. If the production cost of the last 1,000 tons of copper required to supply the demand is more than 12c. per pound, the selling price for all copper should be something above 12c. per pound. Accordingly, the profits of producers who can make it for 5c. or 6c. or 7c. will be proportionately larger. A significant exhibit appears in the recent report of a large zinc-lead producer, the Consolidated Mining & Smelting Co. of Canada. Earnings last year were $11,215,316 on a capital shown in the balance sheet to be $12,675,300. It is doubtful if anything to compare with this can be found in the manufacturing industries.

A good argument can be advanced to support the plan of creating "vertical" combinations to include mining, smelting, refining, and manufacturing operations. A company with all these activities is more likely to avoid bad years, because of the diversity of its sources of income. But the fact remains that mining, as a consequence of inherent characteristics, affords the possibility of very large returns on capital investment, which is lacking in a manufacturing enterprise.

Lightning Creek Gold Gravel & Drainage Co.

THE *United States Daily*, a paper recently launched in Washington to publish Washington news in an unbiased manner and without editorial comment or opinions, can do much good in informing the public on all daily happenings in the national capital. This is shown in its issues of March 20, 22, and 23, in which is published the complete text of the solicitor's ruling in issuing a fraud order in the case of the U. S. Postoffice Department vs. Lightning Creek Gold Gravel & Drainage Co., Charles H. Unversagt, et al. This opinion sums up the methods used by Unversagt to extract gold from the pockets of his clients, for which he gave them a "bullion warrant" for a definite quantity of unmined gold securely locked beneath 165 ft. of gravel, and so widely scattered that even New York's expert burglars could not rob nature's treasure chest.

The *Daily* has done an excellent piece of work in this exposé, and it will undoubtedly reach many readers who are investors in mining stocks. However, the class of people who are mulcted by promoters of Unversagt's type are not likely to be subscribers to the *Daily* and will, therefore, not be benefited by the results of this ruling, except to the extent that it limits the promoter's operations, rather than enlightens the sucker list. That the general public may be further educated as to the methods of unscrupulous promoters, the *Daily* might well add, "other papers please copy."

Man Killed for a Gold Mine

THE ASSOCIATED PRESS prints a story from Oakland, Calif., of a man killed, supposedly, "for information as to the whereabouts of a mysterious gold mine." And, as evidence: "Last December 12 Timon submitted a sample of ore to a chemist for assay. The sample was assayed at 41c. per ton. The location of his claim is unknown."

We have gone over the above with a number of well-dressed people, not very familiar with mining; and the invariable reply is that it shows the mystery and romance of mining.

Prominent Mining Executives

A. Polhemus Cobb

AS IT HAPPENS, A. Polhemus Cobb, vice-president of the New Jersey Zinc Co., will celebrate his sixty-second birthday anniversary on the day that this magazine reaches its metropolitan readers, for he was born on April 9, 1864, at Hopewell, in Dutchess County, N. Y. He was educated at Flushing Institute, on Long Island, and has since been continuously in the maelstrom of New York City business life. His schooling, if that which he acquired in business and at home be excepted, ended with his graduation from the institute mentioned, at the age of sixteen. He then became a runner for a Stock Exchange house, for three years, and went with the New Jersey Zinc & Iron Co. as office boy, in 1882. He has, therefore, been with that company, and its successor the New Jersey Zinc Co., continuously for forty-four years. Asked if any particular longing to be with a mining company dictated his early choice of an employer, Mr. Cobb said, "No; I merely wanted a job, and some friends in the Zinc company suggested that I come there." A story of his early days shows that Mr. Cobb was not always as well known about the Zinc company's office as he is now, but also shows the confidence that was placed in him even as office boy. The president of the company sent him on an important errand to the president of a neighboring bank. Later the two executives met in the Zinc company's office. "I had an interesting talk with your Mr. Cobb the other day," said the bank president. "Cobb—Cobb," said the other, "why, we have no one here by that name." Then, aside, "Polhemus, come here a minute." "There's your Mr. Cobb," said his visitor. But now everybody knows him, by his last name as well as his first. Mr. Cobb was made secretary of the company in 1894. In those days it was known as "the zinc trust" and its operations were almost entirely in the East. In 1897 a consolidation was effected with several other companies and the ramifications of its business were thus extended over a large part of the country. The New Jersey Zinc Co. has two vice-presidents who are in direct charge of its affairs. J. E. Hayes is vice-president in charge of operations and A. Polhemus Cobb is supreme in the financial department, including accounting and sales. He holds many other offices in the subsidiary companies—"so that there will be some one around here to sign checks," as he modestly says, but really so that his acknowledged great ability as a business organizer and a diplomat can be utilized to the fullest advantage. His duties, therefore, have taken him all around the country, at the various subsidiary plants. Mr. Cobb has always taken a great interest in broadening the zinc industry and increasing the co-operation among its various units. From its inception, he has been vice-president and chairman of the executive committee of the American Zinc Institute and for the last year its president. He has been particularly interested in the standardization and improvement of zinc-coated sheets. One of the marked steps taken by the industry during the last year has been the appointment by the Institute of an adjustment committee to solve certain major problems in the buying and selling of ore in the Joplin-Miami district. This committee has had several meetings during the year, and its report is awaited with great interest by both the producing and consuming branches of the industry.

A. POLHEMUS COBB

Modesty is perhaps the outstanding characteristic of Mr. Cobb, though his democratic attitude and his desire for the well-being of his fellow man must be emphasized. He is the kind of a man the zinc industry needs. One of the men who knows him best characterizes him as his "ideal of a Christian business man." He is a member of several clubs and religious organizations, and serves in an official position with the Y. M. C. A. He plays golf for recreation, being a member of the Sleepy Hollow Country Club, near his home at Tarrytown, N. Y.

Mr. Cobb is tall and straight and the picture of good health. Now in his sixties, he will not be an old man for a good score of years to come. His family includes two married daughters and an unmarried son; and three grandchildren are decidedly worth mentioning, in Mr. Cobb's opinion.

Differential Flotation of Copper at Cananea

Elimination of Pyrite Has Increased Ratio of Concentration From 2½:1 to 10:1—Recovery Also Improved—Mine Water, Almost Hopeless, Now Treated and Used in Mill

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A. T. Tye

DIFFERENTIAL flotation of a copper ore containing large amounts of pyrite offers no unusual difficulties when the ore is unoxidized and when fresh water is available. At Cananea, however, several elements unite to interfere with the process, and therefore the following account will deal principally with these unusual features and give in detail the methods used in overcoming them. Some of the unfavorable factors which had to be overcome at Cananea were: The water supply of the concentrator is derived entirely from the water pumped from the Capote 15 mine, which is extremely injurious to flotation, owing to the immense content of ferrous, ferric, and manganese salts, and sulphuric acid. It is impossible to use it in differential flotation unless it is carefully handled and treated before being used. The ore from Capote 15 mine contains a large amount of these same soluble salts, which are detrimental to flotation, so that even when the water to the mill has been treated these salts will dissolve out of the ore while grinding. This ore contains about 33 per cent of pyrite, microscopic examination showing that the ore would have to be ground to 400 mesh to free the copper minerals from the inclosing pyrite. As a result of the use of the caving system of mining, some of the ore in the older parts of the mine has been broken for several years, and, although assays may show no oxide copper, it is extremely rebellious ore for flotation.

The two examples given below indicate the change in the analysis of Capote mine water from 1922 to 1924 due to underground leaching operations. The amount of contained salts varies widely with the proportion of leaching plant water that is present at the moment.

Capote Mine Water Analysis in Parts per Million

Date	Ferrous	Ferric	Cu	CaO	SO_3	Alkalinity (CaO)
Feb. 18, 1922	30	70	17	....	.....	Acid, 85
Jan. 14, 1924	980	1,160	42	200	2,572	Acid, 40

The following analyses show the effect of lime on the treatment of dam water, a sample of which was made alkaline by the addition of lime, using phenolphthalein as indicator:

Dam Water Analyses in Parts per Million

	Ferrous	Ferric	CaO	SO_3	Cu	Alkalinity (CaO)
Dam water...	400	200	470	2,270	28	Neutral to phenolphthalein
Same, treated and filtered	Tr.	Tr.	1,420	2,106	17	

The precipitate gave the following analysis in per cent: Fe, 20; S, 5.8; Mn, 11.0; Cu, 16.5; CaO, 3.4; SiO_2, 3.2; and Al_2O_3, 3.0.

One can appreciate better the real nature of this water after having seen it made alkaline with lime. At first a light yellowish flocculent precipitate develops as a small amount of lime is stirred in. Then, as the final amount of the required lime is added, the whole mass of water takes on a deep bluish-black color and the consistency of the water approaches that of thin soup. The manganese salt is the last to settle out, as a pink precipitate. Finally the floccules settle, leaving a clear liquid of the analysis shown above.

The Capote 15 mine water runs down the arroyo to the tailing dam, from which water is pumped to the two 100,000-gal. storage tanks at the head of the mill.

Soluble Salts in the Ore

That the undesirable salts are also found in the ore is shown by the following analyses of the water entering the primary rod mill and the water leaving the rod mill after contact with Capote 15 ore. The ore from the Elisa mine shows very little of these soluble salts:

Rod-Mill Water Analyses in Parts per Million

Water	Ferrous	Ferric	CaO	SO_3	Mn	Cu	Alkalinity (CaO).
Rod-mill inlet	20	Trace	1,160	1,999	Trace	Trace	89 P.; 112 M. O.
Rod-mill outlet	560	430	900	5,728	104	10	Neutral

P. = phenolphthalein; M. O. = methyl orange.

A laboratory test was made to determine the water-soluble salts in Capote ore. Five hundred grams of ore was crushed through 28 mesh and ground twenty minutes in a ball mill with 500 c.c. of water. This was washed out with 500 c.c. of water and the water decanted and analyzed, showing 400 parts per million of iron and 1,193 parts of SO_3 (1.6 lb. iron per ton of ore).

The following flotation laboratory tests, Nos. 6,084 and 6,090, will indicate the nature of the tarnished ore. Tests 6,070 and 6,071 are on freshly broken ore:

Test	Per Cent A.S. Cu.	Per Cent A. S. Fe.	Per Cent W. S. Fe.	Per Cent Tailing, Cu.	Flotation Recovery Per Cent Cu.
6084	Nil	5.2	0.6	1.10	60.7
6090	0.01	4.8	0.6	1.41	7.6 (extreme case)
6070	0.07	5.2	0.3	0.17	97.2
6071	0.04	5.6	0.2	0.09	95.3

A.S. = acid soluble. W.S. = water soluble.

It will be noted that the assay for acid-soluble copper is of very little value as indicating the floatability of the copper, and as the acid-soluble iron is the same in two of the tests, the only indication of the refractory nature of the ore is contained in the assay of water-soluble iron. Comparisons of the tests on tarnished ore with those on freshly broken ore shows the great importance of the method of mining on flotation results, which cannot be anticipated from the chemical analyses.

The Capote 15 mine is the principal source of concentrating ore of the Cananea company. It contains, however, a large amount of pyrite, and made a very low

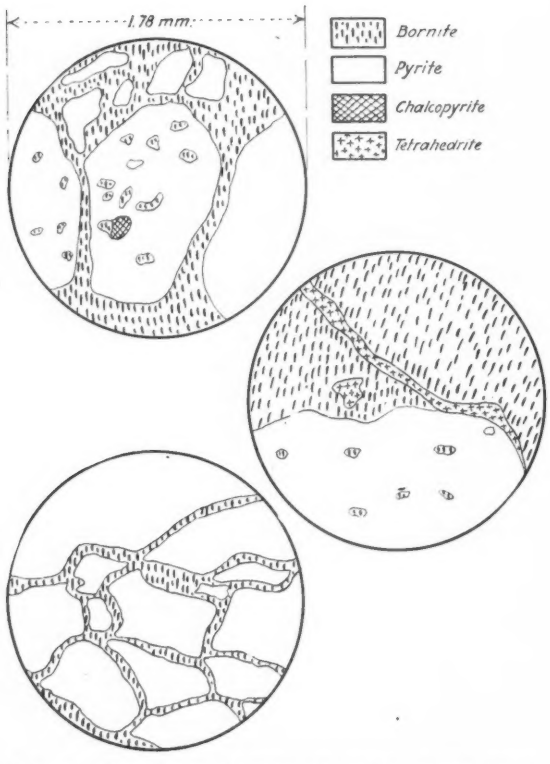


Fig. 1—Ore from Capote 15 mine, 1,000 level, showing different fields of the same sample

ratio of concentration by gravity concentration and bulk flotation. The smelter is less than a mile from the concentrator, so that the cost of transportation is not of great importance, but the high content of iron and sulphur in the ore made it necessary to smelt an immense amount of barren pyrite to obtain the copper contained in the concentrate. In 1923, for instance, the ratio of concentration was only 2.65 into 1, so that with a daily tonnage milled of 1,500 tons it would have been necessary to smelt 622 tons of concentrate per day. This concentrate assayed only 4.38 per cent copper, owing to the great dilution of the copper by the barren iron sulphide. By differential flotation, in July and August, 1925, the ratio of concentration had been increased to 10.7 into 1 and the concentrate assay to 19.20 per cent copper, so for the same tonnage milled it was necessary to smelt only 140 tons of concentrate per day. The following description of the ore by Dr. Graham John Mitchell will also indicate how the copper minerals are included in the barren pyrite as shown in the microdrawings, Fig. 1:

"A microscopic examination of concentrates of the Capote 15 ore reveals structural relationships between the sulphide and gangue which influence the degree of grinding necessary to separate these minerals one from the other. The samples studied are of plus 48, 65, 100, 150, 200, and minus 200 mesh and are comprised of pyrite, chalcopyrite, chalcocite, bornite, sphalerite and galena minerals, quartz, and feldspar. Of the minerals listed, pyrite is the most abundant. The proportion of copper suphides varies in different portions of the same sample. However, the total quantity of chalcopyrite and chalcocite is greater than that of bornite.

"The sulphides and gangue are intimately associated, occurring as inclusions and as particles adhering to each other. Pyrite with included chalcopyrite and chalcocite is common. The latter minerals are also present as attached particles and thin coatings on the edges of pyrite. Inclusions of bornite are also present in pyrite. Sphalerite in some instances shows a thin coating of chalcocite, while other fragments of the zinc contain included chalcopyrite. In some cases quartz and feldspar contain inclusions or adhering particles of the sulphide minerals. The size of inclusions ranges from submicroscopic specks to particles 0.50 millimeters or larger.

"A comparison of the six samples shows that a progressively cleaner separation of the mineral is obtained as the degree of grinding is increased. . . .

"The rocks in which the Capote 15 second-class ore occurs are granite-porphyry and alaskite. These rocks are intimately associated, the granite-porphyry being the older. As hosts for ore they are quantitatively of equal importance. The principal minerals in the granite-porphyry are quartz and orthoclase, both of which show varying degrees of alteration to sericite. . . .

"The alaskite is a very fine-grained, siliceous, light-colored rock composed chiefly of quartz and orthoclase. These minerals are sometimes completely altered to sericite. What appears in hand specimens as fresh rock is found upon microscopic examination to be strongly affected by seritization."

Early Selective Tests

In 1920 sludge acid and sulphuric acid were used as flotation reagents in the concentrator. During the shutdown in 1921 tests were run on the various ores to determine if equally good results could be obtained without these expensive and not altogether satisfactory reagents. It was found that coal tar and pine oil gave as good results as any of the reagents tested. It also developed that the limitation of reagents resulted in a tendency for differential flotation and a higher ratio. The suggestion was made that lime would make a good differential flotation reagent, was cheap, and could be produced locally. O. C. Ralston had shown ("Flotation," 1917, p. 120) that pyrite was "retarded" in flotation by the use of lime.

During the summer of 1921 reports were received of the differential results obtained at the test plant of the Granby Consolidated Copper Co. at Anyox, B. C., so tests were made by the methods in use there. However, the Granby reagents did not seem particularly applicable to Cananea ore, so tests were resumed with coal tar, pine oil, and lime, with the following results in per cent:

		Test No. 1	Test No. 2	Test No. 3	Test No. 4
Feed:	Cu	2.05	2.09	2.08	2.10
	Fe	11.20	11.40	11.60	11.00
	S	12.50	12.50	12.60	12.20
	Oxide	0.01	0.01	0.01	0.01
Concentrate:	Cu	7.60	10.16	11.88	15.28
	Fe	34.00	33.40	31.00	19.60
	S	41.00	40.00	38.40	25.20
	"Insoluble"	16.01	14.80	17.40	35.20
Tailing:	Cu	0.18	0.18	0.17	0.16
	Fe	3.60	6.20	7.80	9.80
	S	3.00	6.10	7.60	10.20
Ratio of concentration		3.98	5.24	6.13	7.78
Recovery, per cent copper		93.4	93.1	93.2	93.3
Rejection, per cent iron		24.0	44.0	56.0	77.0
Pounds of lime per ton		0.0	1.0	2.0	3.0

These tests were with freshly broken ore. Samples were obtained from various chutes in the Capote 15 mine, and it was found that the degree of tarnish, indicated by a reddish tinge to the ore, had a big influence on the results obtained. These tests were with tap water free from impurities, but tests were also made with dam water and with Capote 15 mine water, and it was found that, when the alkaline tailing water from one test was used in the flotation test of another sample, very satisfactory results could be obtained. The dam water at that time contained relatively small amounts of dissolved salts.

A great many tests were made, and, though it was realized that oxidized ores and bad water might give trouble, it was thought that an all-flotation flow sheet would be better than a combination, even though differential flotation was not a success. Consequently, the concentrator was rebuilt on this basis, but with finish-

ing tables provided following flotation. When operations were resumed late in 1922 it was found that the ore being received was quite badly tarnished, a considerable portion coming from stopes which had been broken for years. Also, the mine water was more foul than formerly, owing to underground leaching operations, and the combined flow sheet was followed until April, 1924.

Pilot Mill Proves Its Worth

Late in 1923 tests on differential flotation were again taken up at Cananea and also at Inspiration and at the Utah Consolidated concentrator, using the chemical reagents which had then been developed, and with such success that a pilot plant was arranged to try it in actual operation. At the Utah Consolidated, differential flotation was at that time in use, as well as at other concentrators. So far as possible, only standard full-size machines used in the concentrator were installed, so as to eliminate all possibility of disappointment due to difference in size or class of machines. The feed was secured from the discharge of one of the primary rod mills as shown in Fig. 2. Two 30-ft. Dorr tanks were used to settle the tailings and to return the alkaline tailing water for reuse. The makeup water required was also added to these tanks, with sufficient milk of lime to neutralize and precipitate the iron and manganese in solution, which precipitate was carried down by the settling tailing, so that only clean alkaline water was utilized. The pilot plant now forms an integral part of the concentrator, and the ball mill and classifier are regrinding 300 tons daily.

T-T mixture (thiocarbanalide and orthotoluidine) and potassium xanthate were tested, xanthate (Z-1) proving the best reagent for Cananea conditions, although the metallurgical results were about equal, as shown by the following tabulation of representative days' operation:

Feed		Concentrate		Tailing		Ratio of Conc.	Recovery % Cu	Reagent Lb. Ton T.-T.	Alkalinity Lb. CaO per Ton Water
% Cu	% Fe	% Cu	% "Insol."	% Cu	% Fe				
1.91	17.0	13.5	12.4	0.16	13.0	7.6	92.7	0.61	0.308
1.95	16.6	10.3	11.6	0.19	11.0	5.8	92.0	0.50	0.196
								Z-1	
1.92	15.4	5.3	4.0	0.17	7.0	2.9	94.1	0.39	0.297
1.92	18.0	5.9	9.4	0.15	8.0	3.2	94.5	0.31	0.252
1.88	15.8	6.7	7.0	0.17	8.0	3.8	93.3	0.24	0.246
1.80	14.6	9.1	5.4	0.15	10.0	5.4	93.2	0.18	0.315
1.91	16.0	10.3	5.8	0.17	11.0	5.8	93.6	0.13	0.329
1.89	16.2	11.7	7.2	0.20	12.0	6.8	91.0	0.07	0.364

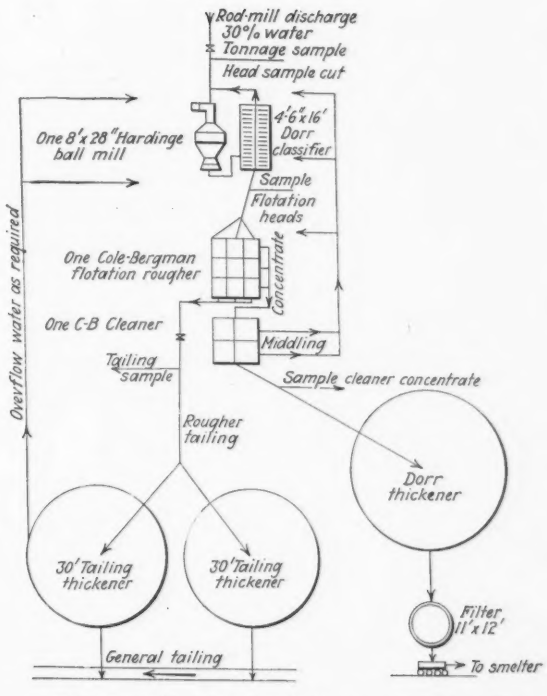


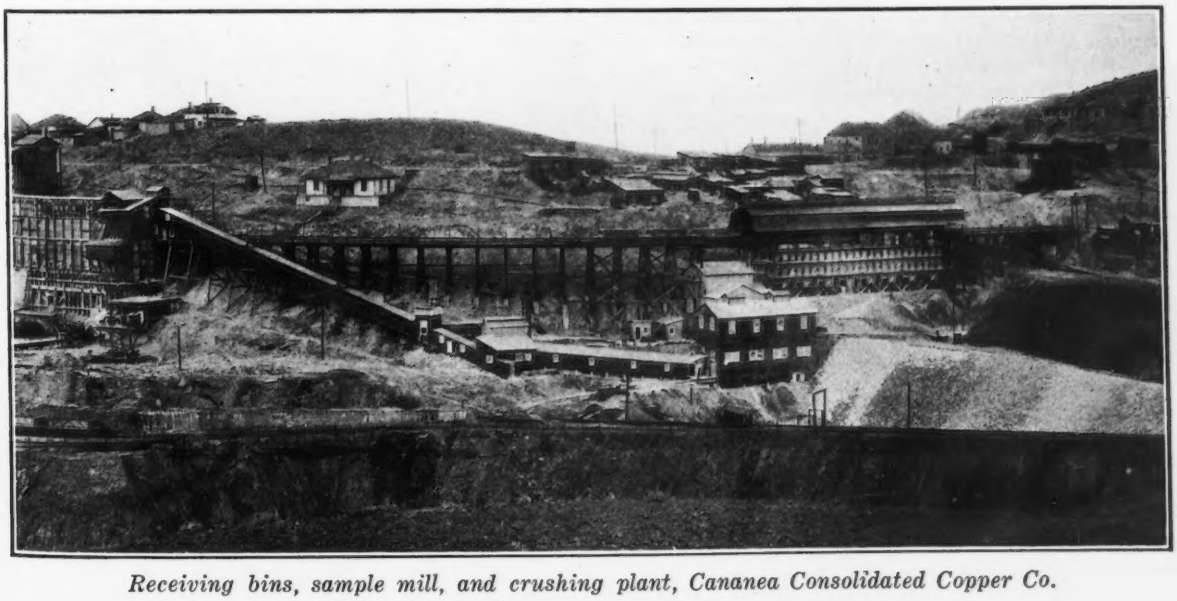
Fig. 2—Flow sheet of Cananea pilot mill

The series with xanthate illustrates nicely the effect of limitation of flotation reagents in increasing the ratio of concentration.

If the pilot mill had not demonstrated that it was possible to utilize the treated water, it is doubtful if the concentrator would ever have been placed on a differential basis, as the mill results at first were very disappointing.

Test in Concentrator Poor at First

By the last of April everything was ready to try the process in the concentrator. For the first month and a half the results were quite poor, owing to the impure water. The tailing dam from which the water was drawn was filled with the impure water and the supply was augmented by the mine water, which was equally



Receiving bins, sample mill, and crushing plant, Cananea Consolidated Copper Co.

bad. The water was neutralized with lime before being used, but it still contained the precipitated iron salts, and no acceptable results could be obtained. This trouble was partly overcome by utilizing all the extra Dorr tanks, of which there were several, to settle out these precipitated salts.

The water from the dam was lime-treated, mixed with tailing, sent to the tanks, and the clear overflow of the latter repumped for mill water. This cut the concentrator tonnage in half, as sufficient water could not be supplied. Therefore, means were provided to add excess lime to the tailing going to the dam to purify all the water in storage, as it was realized that in this way only could the process be applied successfully. This consumed considerable time, and it was June 16 before all the storage water was purified. Since then it has been necessary to use sufficient lime to secure the desired alkalinity for flotation and also to purify the makeup water which comes from the mines. This latter is treated before it enters the tailing pond.

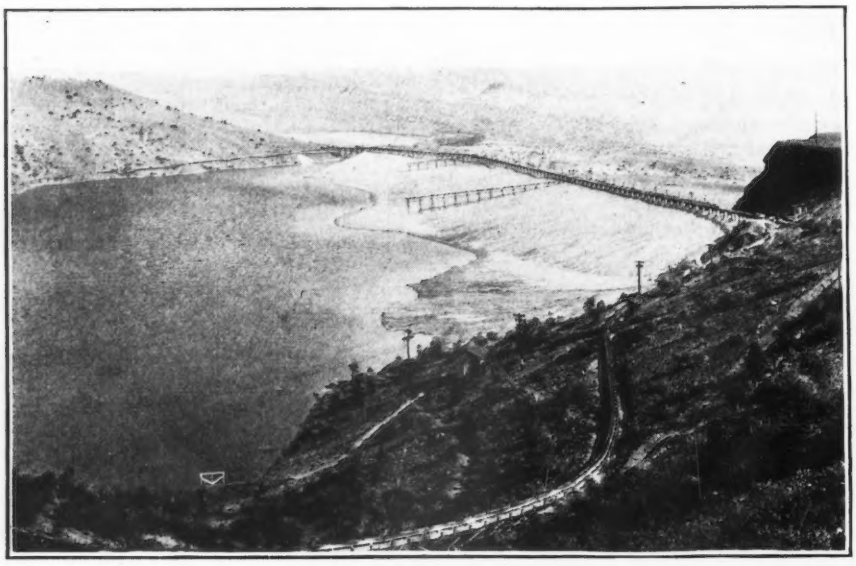
In the meantime, the worst mine water was being segregated and discharged outside the drainage area. The change made in the composition of the great bulk of water in the tailing pond is shown in the following analyses:

Dam Water, Parts per Million

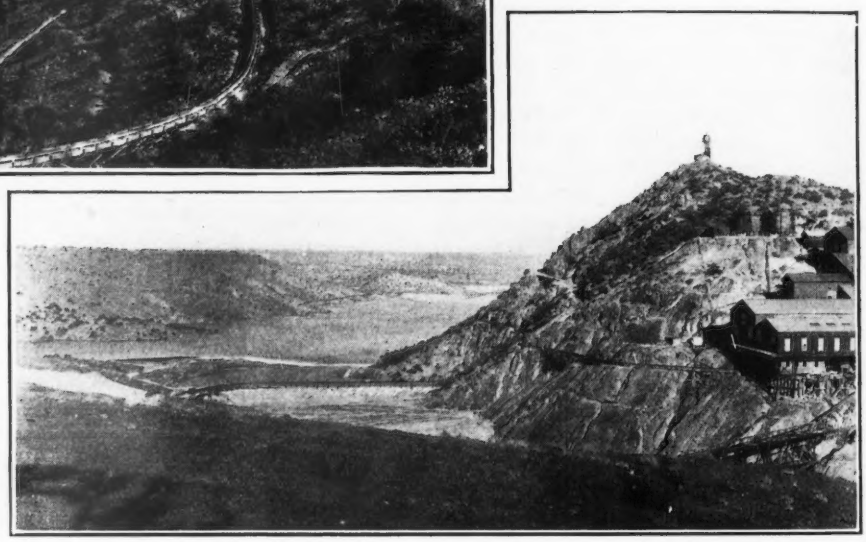
Date	Ferrous	Ferric	Mn	CaO	Cu	SO_3	Alkalinity	Acidity
Feb. 12, 1924	600	120	50	420	42	2,559	Nil	40
June 16, 1924	Nil	Nil	Nil	1,260	Nil	1,749	50 M.O. 39 P.P.	—

When part of the mine water was being precipitated in the 80-ft. Dorr thickener with the concentrates, the moisture in the filter cake increased to 32 per cent and dropped to 17 per cent when this was discontinued, illustrating the gelatinous character of the precipitated salts.

It would have been better to have kept up the old practice and not have started differential flotation until all the water in the dam had been made alkaline and thus purified. If fresh water had been available, differential flotation could have been started successfully from the first day, and even the results now being obtained could be improved with a fresh-water supply.



To the left, part of the tailing dam, the water behind which had to be treated with lime before differential flotation was possible



To the right is shown an arroyo where mine water passes the concentrator. Here, lime is added. The dam is seen in the distance. Note the naval searchlight on top of the hill

The Present Mill Flow Sheet

The average tons treated is 1,500 daily, of which about 80 per cent comes from Capote 15, 15 per cent from Elisa, and 5 per cent from the Veta mine. These are received in separate bins at the crushing plant, which has a bin capacity for 3,000 tons of crude ore, as shown in the flow sheet, Fig. 3, which is self-explanatory.

Each section as installed contained twelve rougher and five cleaner cells each 4x3 ft. Not all of the cleaner cells are in use. The first three cells of the roughers make finished concentrate. The concentrates from the remaining nine cells of two roughers are combined and sent to a cleaner consisting of three cells. There are three such cleaner sections for the six roughers, and the resulting cleaner concentrates are then recleaned in one recleaner section of three cells. The recleaner section makes finished concentrate. About 75 per cent of the total concentrate is derived from the first three

rougher cells and the remainder from the recleaner. Tailing from the cleaner and recleaner machines is returned to the classifiers. The flotation feed amounts to about 2.6 tons per square foot of rougher blanket area and 2.2 tons per square foot of rougher and cleaner area combined. The air pressure is held at 6 lb. on account of the blankets stopping up with lime from the deposit of coarse pyrite which accumulates on them. It requires about 12 cu.ft. of air per square foot of rougher area, and 10 cu.ft. per square foot of rougher and cleaner area combined.

The feed to the 80-ft. Dorr concentrate thickener contains 20 per cent solids and the discharge 75 per cent solids. The spigot varies from $\frac{3}{8}$ to $\frac{5}{8}$ in., and at present a Devereux valve is being tested. This was described in *E. & M. J.-P.* of Sept. 5, 1925, p. 377. The discharge of the thickener goes to one 11½x12-ft. Oliver filter. A vacuum of 22 in. of mercury is maintained, and the filter is blown with compressed air for a few minutes every hour. The filter cake contains about 10 per cent moisture and drops into thirty-ton cars, which deliver it to the smelter.

Three-ply blankets with ½-in. stitch are used, and also National solid-woven blankets. The blanket life has been about twenty-two days, but is now fifty days. The blankets are punched with rubber-tipped punchers to keep them open and make the coarse sand move along to the discharge end.

Cleaning and Recleaning Concentrate

One of the factors in securing a high ratio of concentration and high-grade concentrate consists in cleaning and recleaning. The following tabulation gives the results from different methods:

	Feed		Concentrate			Tailing			Recovery	Alkalinity
Method	% Cu	% Fe	% Cu	% Fe	% "Ins"	% Cu	% Fe	Ratio Conc.	% Cu	Lb. CaO/ Ton H_2O
1	2.07	15.6	20.82	30.0	2.8	0.16	11.8	10.8	93.0	0.520
2	1.72	14.4	18.40	28.6	8.6	0.16	11.0	11.6	91.6	0.448
3	1.75	10.6	21.26	28.4	5.4	0.16	10.4	13.0	91.7	0.527

In No. 1 all the rougher concentrates were cleaned and recleaned. In No. 2 the cleaners and recleaners were eliminated entirely. Clean concentrate was made on the first four rougher cells, and the froth from the remaining eight cells was returned to flotation feed via the classifiers. Both of these systems were in use only a short time, so the operators did not have time to get thoroughly accustomed to them, or the results could probably have been improved. A middle course is exemplified in No. 3, which is the practice at present and is described above. These examples are given to show how flexible the cleaning and recleaning problem may be with certain ores. Recleaning is here considered an aid in dropping the pyrite and gangue, but possibly not absolutely essential to the practice. It is important to run the cleaners and recleaners very slowly. Reducing the percentage of "insoluble" below 7 or 8 does not appear to lower the moisture in the concentrate in proportion.

Grade of concentrate depends also on the ore treated. The Capote 15 makes about 16 per cent copper concentrate, the Elisa about 25 per cent, and the Veta from 30 to 45 per cent, depending on the grade of ore, which varies considerably.

In July, 1925, the iron as sulphide was 89.15 per cent of the total iron, and the amount of iron actually rejected, by difference between the iron in the ore treated and in the concentrate shipped, was 83.0 per cent, showing that 93 per cent of the iron amenable to flotation was rejected.

Dr. Mitchell's photomicrographs show that completely to free the copper minerals from the inclosing pyrite, it would be necessary to grind the ore to 400 mesh. This would be economically impossible. Present practice is to grind to about the following screen analyses:

Mesh	Per Cent by Weight—Tailing	Concentrate
On No. 48	4.4	1.4
65	11.8	7.0
100	11.4	11.0
150	11.2	12.4
200	9.4	10.8
Through 200	51.8	57.4

The sulphide minerals, of course, pulverize more easily.

Classifier overflow is kept at 13 per cent solids, which is lower than common practice. The classifiers have a small settling area, which results in a comparatively rapid flow of pulp, and it is believed that the low percentage of solids has the effect of increasing the preferential grinding of the mineral.

Xanthate Added at the Cells

The xanthate was formerly added at the Hardinge mill discharge and was present in the classifier. This apparently had the effect of causing the overflow of larger particles of mineral, so that the freeing of the copper minerals from the iron was less complete. It also resulted in the presence of comparatively large particles of mineral in the flotation feed, which caused much mechanical trouble in the flotation cells by settling on the blankets. This effect is now overcome by adding the xanthate just ahead of the flotation cells; which was very clearly demonstrated on Inspiration ore in the company's test mill.

So far as possible, the worst of the mine water is discarded below the tailing pond by a pipe line and launder, the rest flowing down the arroyo to the dam. When passing the concentrator, however, milk of lime is run into the arroyo water until it shows distinct alkalinity. Crushed lime is fed into a small ball mill, and a minimum amount of water added while grinding, so that considerable heat is generated in the mill, the lime does

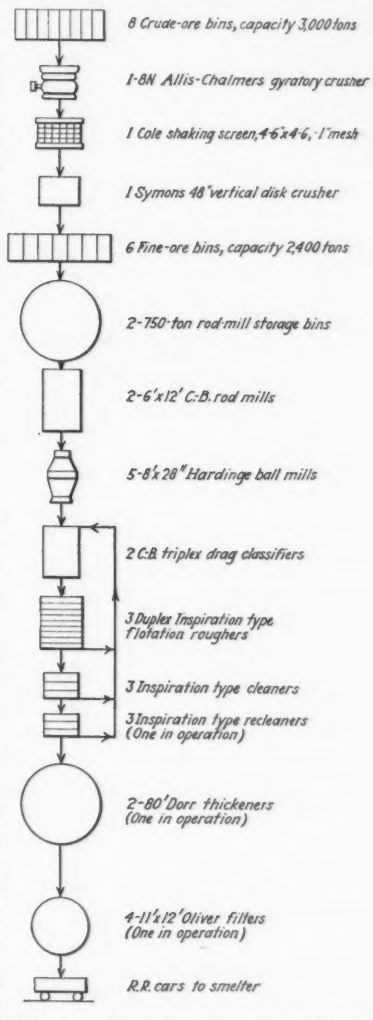

8 Crude-ore bins, capacity 3,000 tons
1-8N Allis-Chalmers gyratory crusher
1 Cole shaking screen, 4-6'x4-6', 1" mesh
1 Symons 48" vertical disk crusher
6 Fine-ore bins, capacity 2,400 tons
2-750-ton rod-mill storage bins
2-6'x12' C.B. rod mills
5-8'x28" Hardinge ball mills
2 C.B. triplex drag classifiers
3 Duplex Inspiration type flotation roughers
3 Inspiration type cleaners
3 Inspiration type recleaners (One in operation)
2-80' Dorr thickeners (One in operation)
4-11'x12' Oliver filters (One in operation)
R.R. cars to smelter

Fig. 3—General flow sheet of the concentrator. See accompanying text for further details

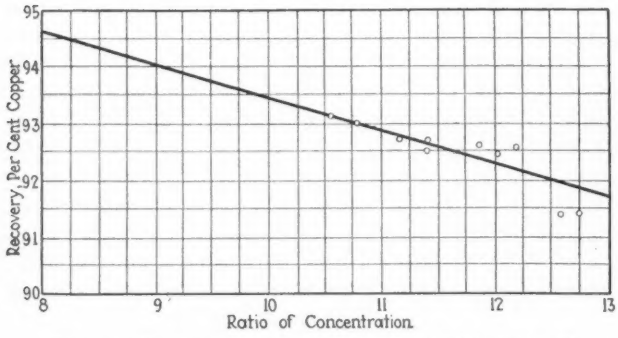


Fig. 4—Copper recovery compared with ratio of concentration, August, 1925

not get "drowned," and the majority goes into solution. This is run into the middle of the stream of water to be treated, and at the same time a small stream of tailing is also discharged with the lime, so that the gelatinous salts are precipitated and the slime and sand of the tailings bury them. At a point below where the lime is added to the arroyo water, a sample is taken every hour and titrated to be certain that sufficient lime has been added.

To overcome the effect of soluble salts in the ore (and to secure the desired alkalinity for flotation), lime is added to the rod mills, the discharge from these being tested every hour. Flotation feed is titrated for alkalinity hourly. The dam water is used throughout the mill, and is alkaline to the extent of about 0.05 lb. of CaO per ton of water. This is also titrated hourly. The lime used is burned locally by the company and costs $6.50 per ton.

Metallurgical Control of Mill Operations

The discharge from the primary rod mills is run to the ball mills. This gives better results than when run to the classifiers, which was formerly the practice before differential flotation was used. Possibly the lime gets more action and is in contact with the coarse grains of ore being ground, and any coarse lime particles are ground still finer. This precaution does not appear to be so important as it was when the system was first started and before the water was thoroughly under control.

The percentage of solids in the classifier is held at 13, although requiring a large amount of water for reasons previously discussed. Likewise, xanthate is fed as near the feed end of the flotation unit as possible. It will be noted in Fig. 4 that as the ratio of concentration is increased, owing to the rejection of pyrite, the recovery of copper decreases. If the grinding were finer the ratio of concentration and the recovery would be higher and also the percentage of iron rejected, but the capacity of the concentrator would be decreased so that, economically, nothing would be gained. The pyrite dropped by differential flotation contains about 0.50 per cent of copper, so that the mechanical loss of copper included in the pyrite is of some importance.

Best results are with an alkalinity in the flotation feed equal to about 0.55 lb. of CaO per ton of water. All the flotation cells, both roughers and cleaners, are boarded up on one side so that only one side overflows concentrates, and all are run very slowly. This is very necessary for the production of high-grade concentrates. The system of cleaning and recleaning is described above.

Flotation reagents used are potassium xanthate, steam-distilled pine oil, and lime, the average pounds per ton being 0.09 xanthate, 0.23 pine oil, and 9 to 11 lime. The lime includes that used in treating the mine water and varies considerably from month to month, depending on the purity of the water and character of the ore. In extreme cases it has averaged 12.5 lb. for a month. Likewise, for considerable periods the xanthate has been as high as 0.12 lb. per ton. The large amount was used to counteract the effect of having a bad run of ore, but did not seem to be economical, as it lowered the ratio of concentration without a compensating higher recovery. In exceptionally favorable conditions, the xanthate has been as low as 0.07 lb. The xanthate is used as a 25 per cent solution made up fresh each shift. The so-called Z-1, Z-2, and Z-4 have been used at different periods, but Z-3 is now regularly employed.

As above mentioned, the character of the ore is of great importance and varies in the Capote 15 mine with

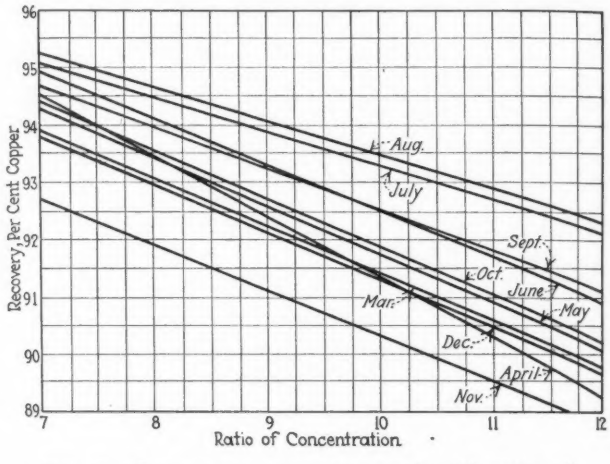


Fig. 5—Copper recovery compared with ratio of concentration, monthly, March to December, 1925, inclusive

the mining method employed. The ore is caved in sections on the various levels, and each section, when broken, is overlain with waste or mixed ore and waste. The first drawings from a section are absolutely freshly broken, but as drawing continues, more and more of the overlaying material becomes mixed therewith, until it finally becomes so low-grade and tarnished that this section is abandoned and a lower level is started. This results in more or less of a cycle, which is somewhat equalized by the fact that more than one section is always being drawn at a time.

The metallurgical results for last August are given as representative of the best. Since then the results have been somewhat poorer, owing to ore and water conditions, but have recently been on the up grade again. Water conditions were especially favorable in July and August, for the reason that the rainy season was then on.

In judging daily or monthly results two factors must be considered, ratio of concentration and recovery of copper, either of which can be bettered at the expense of the other. In March, 1925, was started the practice of taking a whole month's daily results and grouping them according to the ratio of concentration, then averaging the ratios and recoveries in groups of certain ranges of ratios. That is, there would be groups where

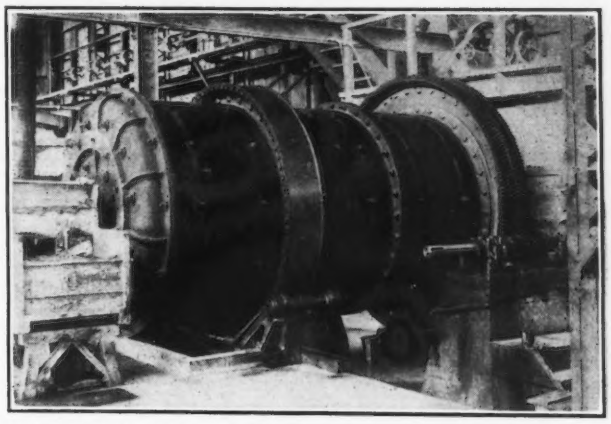
the ratio was 8, 9, 10, or 11, for example. When these points were plotted, using ratios as abscissas and recoveries as ordinates, a curve was obtained that was practically a straight line and which showed for that month the extraction corresponding to a given ratio. Such a curve is kept before the concentrator foreman, and each day's results are plotted thereon. A point above the line represents better than average work, whereas a point below is poorer. Likewise, the monthly curves are worked up and plotted on the same sheet; for the months from March to December, 1925, inclusive, these are given in Fig. 5. Undoubtedly, this curve would not be a straight line if carried to extremes in either direction.

There follow the average figures for the last six months of 1925 and, for comparison, the last six months of 1923, before differential flotation was used:

	Last Half 1923	Last Half 1925
Cost per ton (concentrating)	$0.83	$0.90
Dry tons concentrated	252,020	274,928
Ratio of concentration	2.575	10.18
Copper recovery	87.40	91.17
Silver recovery	88.21	90.18
Gold recovery	95.80	88.82
Kw.-hr. per ton	15.8	18.202
Coal tar, lb. per ton	1.243	.....
Fuel oil, lb. per ton	1.137	.....
Pine oil, lb. per ton	0.608	0.227
Xanthate, lb. per ton	.....	0.090
Lime, lb. per ton	.....	11.18
Copper in ore, per cent	1.95	1.91
Iron in ore, per cent	16.7	15.7
Copper in concentrate, per cent	4.38	17.69
Iron in concentrates, per cent	36.0	30.2
Copper in tailing by assay, per cent	0.297	0.17
Copper in tailing, calculated, per cent	0.393	0.19
Iron in tailing, per cent	5.2	12.1
"Insol." in concentrate, per cent	15.20	7.3
Moisture in concentrate, per cent	11.4 (a)	9.1

(a) Average moisture in gravity and flotation concentrates; gravity concentrates contained 7.76 per cent moisture and flotation contained 18.67 per cent.

The economic importance of differential flotation to Cananea can be estimated from the fact that the ratio of concentration by the old flow sheet was about 2.65 into 1, whereas it is now 10. The cost of smelting a ton of the present concentrate is somewhat higher than it would be for smelting a ton of the former, as the higher copper content makes more matte to convert per ton of concentrate. Before differential flotation was introduced, about 600 tons daily had to be treated in the blast furnace on account of lack of reverberatory capacity. Reducing the tonnage of concentrate made



Rod mill handling 800 tons per day, grinding from 1½-in. feed to 1 per cent on 8 mesh; 43,000 lb. 3¼-in. rods, with power input of 84 kw.

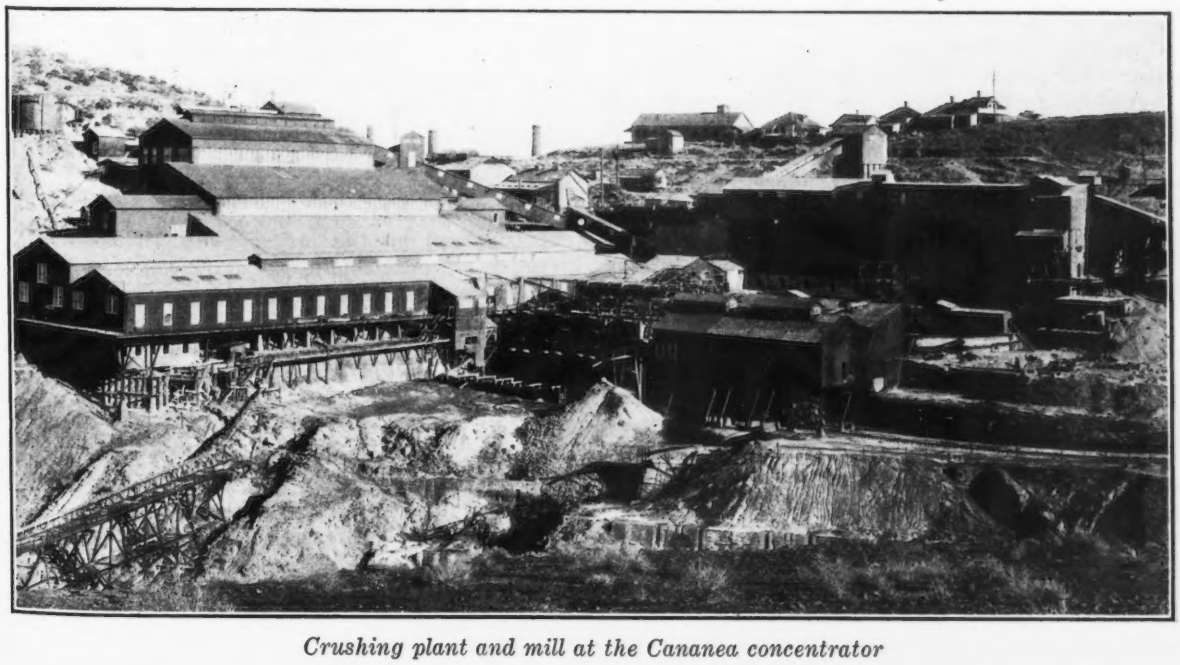
Treatment, Production and Losses, August, 1925

Treated	Dry Tons	Copper Per Cent	Copper Tons	Silver Assay	Silver Oz.	Gold Assay	Gold Oz.	Total Per Cent Treated
Capote 15	34,944	1.70	593	0.27	9,326	0.002	69	78
Elisa	9,647	2.79	268	1.75	16,871	0.003	29	22
Total treated	44,591	1.93	861	0.59	26,198	0.002	98	100
Concentrates Produced								
From Capote 15	3,247	16.67	541	2.47	8,022	0.018	58	Calculated
From Elisa	927	27.34	253	15.64	14,512	0.026	25	
Totals	4,175	19.04	795	5.40	22,534	0.020	83	
Losses								
Tailing to dam	40,416	0.15	60	0.06	2,425	Trace	15	
Unaccountable	.....	....	6	....	1,238	.....	....	
Totals	40,416	0.16	66	0.09	3,663	Trace	15	

Per Cent Recovery			Ratio of Concentration
Copper	Silver	Gold	
92.29	86.02	84.21	10.68

Analyses

	Per Cent Cu	Oz. Ag	Oz. Au	Per Cent SiO_2	Per Cent Al_2O_3	Per Cent Fe	Per Cent CaO	Per Cent S
Capote 15	1.70	0.27	0.002	44.2	6.4	17.0	0.2	14.9
Elisa	2.79	1.75	0.003	32.0	5.5	17.2	19.3	5.7
Concentrate	19.04	5.40	0.020	5.7	2.0	29.0	0.3	34.9
Tailing	0.15	0.06	Trace	47.2	10.8	13.6	5.3	9.5



Crushing plant and mill at the Cananea concentrator

it possible to shut down all the blast furnaces and divert this tonnage to the reverberatory department, with a material saving per ton. The concentrator tailing formerly contained about 5 per cent iron and sulphur. It now contains 14 per cent, which will indicate the amount of these elements that has been eliminated from the smelting operation.

It was expected that the concentrator recovery would decline, but, on the contrary, it has improved. It was also expected that the cost per ton for concentration would be higher, but it is actually about the same. So many basic conditions, such as the cost of oil used in producing power and the cost per unit of flotation reagents, and many other items, have changed materially, that it is beyond the scope of this article to present detailed comparisons. The only item of expense that is intrinsically higher with the differential flow sheet is the cost of grinding. About 2 kw.-hr. per ton more is now used than formerly. Repair costs have been materially reduced, owing to the alkaline water used, as formerly the impurities present were destructive to the equipment. Also, when high-grade concentrates were produced the smelter extraction was increased, and a way was paved for quite a radical change in the reverberatory department operation, which has resulted in important economies.

Oil Possibilities Studied in Alberta and Saskatchewan

Broad Ribstone-Blackfoot Anticline Considered the Best Structure in This Part of Provinces to Test for Gas

A REPORT by Dr. G. S. Hume, of the Geological Survey of Canada, on his work in eastern Alberta and western Saskatchewan is being circulated in preliminary form, and copies may be had on application to the Director, Geological Survey, Ottawa. In 1924 a reconnaissance study was made of a large area in Alberta east of the Wainwright field. During 1925 a more detailed examination was made of the area in the vicinity of Battle River, between Range 24 west of the third meridian and Range 3 west of the fourth meridian. Following this detailed work, a reconnaissance survey was continued over an area in Saskatchewan between latitude 52 deg. and the North Saskatchewan River and longitude 108 deg. and the fourth meridian. This work was carried into Alberta south of Wainwright to latitude 52 deg. and between the fourth meridian and longitude 111 deg.

Descriptions are given in the report of the geological formations, and data are presented in detail that have a bearing on the interpretation of the structural features—matters of very direct interest to companies planning a campaign of drilling operations.

Everywhere in the area studied the regional dip is gentle. Local tilting of the formations such as is found in the vicinity of Tit Hills is believed to be due to superficial causes and has no relation to underground structure. Difficulty is had in finding strata that can be traced laterally to any extent, and consequently not as much can be done as might be desired in determining structure by the leveling of key horizons. Detailed leveling was possible, however, on an anticline on Battle River in the vicinity of the Alberta-Saskatchewan boundary. This is named the Ribstone-Blackfoot anticline. It has a northeast-southwest strike and the crest lies in the vicinity of the exposure of the Ribstone Creek formation two miles southwest of the mouth of Ribstone Creek, probably about Sect. 12, T. 46, R. 1, west of the fourth meridian. The rate of dip on the northwestern flank of this anticline is about 23 ft. per mile for 12 miles northwest, and on the southeastern flank 7 to 10 ft. per mile southeasterly for an unknown distance.

The question whether such a broad anticline is likely to have been favorable to an accumulation of gas and oil is not easy to answer without drilling, even supposing other conditions than structure are entirely favorable. There is some reason to believe that gas may be present, but in Dr. Hume's opinion a sharper fold would be more favorable for oil. A flow of gas was obtained at 290 ft. in a water well drilled in Sec. 24, T. 46, R. 1 west of the fourth meridian. It is thought that this gas flow must be derived from the base of the Ribstone Creek formation, and the fact that the well is located on the northwest flank of the anticline leads to the conclusion that this shallow gas is associated with the structure. If such is the case, it would seem reasonable to suppose that a structure sufficient to cause an accumulation of gas at a shallow depth where seepage to the surface would be comparatively easy might also cause a much larger accumulation at depth, provided strata of sufficient porosity to act as a gas reservoir are present under conditions favorable for the retention of the gas. From wells drilled in various localities in the plains, sands of sufficient porosity to carry oil and gas are known to be present at the base of the Colorado and in the Lower Cretaceous. There is no known reason to assume their absence at this locality, and the Benton shales form an effective cover for a gas or oil field. Thus, although the structure as interpreted seems to be quite broad, it is the best known structure in this part of Alberta and Saskatchewan to test for gas, the closure of the structure in an east-west direction being several times that of the Wainwright structure in which oil and gas have been found. In this discussion the merits of this fold as a cause of the accumulation of oil and gas have been considered only in relation to the fold itself. It happens that the crest of this minor fold coincides with that of a much broader regional one, the minor fold being superimposed on the larger one. Evidence for this broader regional folding is quite conclusive. It is a reasonable conclusion that the larger regional structure as well as the smaller local structures has had some influence on the accumulation of oil and gas, and as the tendency is for oil and gas to accumulate toward the crest of any structure, the crest of the major structure would be considered to be a favorable location. But since, as has been pointed out, the crest of the major structure coincides with that of a well-marked minor structure, there is a further reason for regarding the minor anticline as a structure favoring the accumulation of oil and gas.

Dr. Hume discusses the chances for the occurrence of oil in this structural feature and offers suggestions as to the location of test wells.

Mining Tungsten at Pine Creek

Property, Operated at 11,000 Ft. Elevation, Handicapped by Climate and Lack of Transportation

By George J. Young
Associate Editor

THE Pine Creek tungsten mine, operated by the Tungsten Products Co., of Bishop, Calif., is unique in being in a high mountain cirque close to the eastern scarp of the Sierra Nevada Mountains west of Bishop, Calif., at the head of Pine Creek. It is the only mine in California that is operated at as high an altitude. Another mine operated in the high mountains of California was the Lundy gold mine, in Mono County, but work ceased there a number of years ago.

M. B. Sherwin, a mineral surveyor, discovered the Pine Creek mine. The deposit was at first thought to be silver-lead and was located as a silver property, but the location was allowed to lapse when the assay results were obtained. In the spring of 1916, Sproule and Vaughn, prospectors, went up to the old claim during a blizzard and relocated the claims. They remembered that garnet had been found on the claims.[1] Samples were brought to Cooper Shapley at Round Valley, and the assays showed 1½ per cent of tungstic acid in the form of scheelite. In the fall of 1916, Shapley visited the claims and sampled the outcrop. He succeeded in getting F. B. Close and his associates interested in the property in 1918, and a mill was erected. The property was closed down in 1919 during the slump in the tungsten market, and only recently work was resumed by the Tungsten Products Co., which purchased the property from the Pine Creek Tungsten Mining Co. This company, to improve ore-handling conditions, drove a lower adit, separated by a vertical distance of 350 ft. from the upper adit, which gave access to the chute raises connecting with the glory hole. A 70-deg. transfer raise which branches near the top, each branch being provided with a rail grizzly at the top, connected the two adits. The broken ore is drawn from the glory hole through the chutes into cars and trammed a short distance to the grizzlies. The lower adit is about 1,800 ft. long. Ore is now hauled in six-car trains by mules to a bin at the head of a gravity tram leading to the mill.

The scheelite is associated with a garnetiferous rock which occupies an irregular zone between granite on the west and a limestone formation on the east. The deposit is on the west side of a steep outlying ridge trending toward Pine Creek canyon on the south. On the east side of the garnetiferous zone is a lens of powellite (calcium molybdate), a greenish yellow mineral, the extent of which is not known. The metamorphic formation in which the granite is intrusive is a roof pendant such as has been described by Knopf[2] in his paper on the Bishop tungsten deposits. The altitude of the upper outcrop of garnetiferous rock and associated powellite is about 12,000 ft. Mine workings are several hundred feet lower, the altitude of the upper adit being about 11,400 ft. and the lower adit about 11,000 ft., or at timber line. The camp, a short distance from the mill, has an altitude of 10,500 ft. A mountain trail connects the camp with the road in Pine Creek Canyon. This road terminates at an altitude of 8,500 ft.

Concentrating mill, Tungsten Products Co., at the timber line

Mining is confined to the operation of a glory hole or open pit which centers on two chute raises and is 90 ft. above the upper adit. The ore forms a prominent pinnacle on one side of the glory hole. Ingersoll-Rand drills, No. 248, are used in adit work; Sullivan D. P. 33 and Denver Rock Drill No. 93, hand-held drills, in glory hole work, and a No. 73 wet stoper for raising. Low freezing 40 per cent Hercules powder is used in blasting. Holes range from 6 to 14 ft. in depth. Four men are required in mining and from two to three in block-holing. Five men are employed in the upper adit in pulling chutes, tramming to raises (100 ft. is the maximum tramming distance), and reducing oversize ore to 9-in. grizzly size.

On the lower adit six men, two per shift, load the ore train, six 19-cu.ft. cars, and take it to the bin serving the gravity tram. Eleven trips are averaged per shift. A blacksmith shop equipped with a power sharpener is at the portal of the upper adit and the compressor equipment at the portal of the lower adit. The latter consists of four 250-cu.ft. Ingersoll-Rand compressors, each driven by a 25-hp. motor and short center belt. Mine production averages 4,000 tons per month, although 200 tons per day is handled when everything is moving properly.

The mill is on a steep slope of granite not far from the camp. Ore is discharged into a pocket serving a 10x20-in. jaw crusher, the crushed product falling upon a grizzly serving a 9x15-in. jaw crusher; undersize and product from the second crusher is received upon a belt conveyor and delivered to the mill bin. Ore from ¾ to

[1] This area is distinct from the Bishop tungsten area described by Adolf Knopf. In the Bishop area scheelite was discovered in 1913 and commercial exploitation was started in 1916. The fact that scheelite was associated with garnetiferous rock became generally known to prospectors and they used this information in hunting for similar deposits.

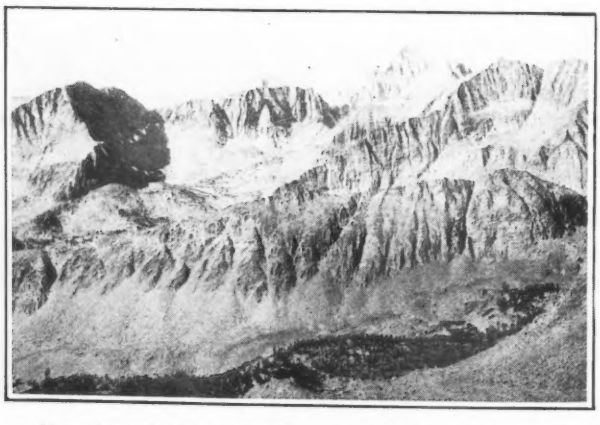
[2] "Tungsten Deposits of Northwestern Inyo County." Bull. 640-L, U. S. Geological Survey.

Outcrop of tungsten deposit, showing upper and lower adits at B and A

1½ in. in size is fed by an apron feeder to two ball mills, which discharge to a bucket elevator feeding two impact screens (16 mesh), the oversize being returned to the ball mills and the undersize being laundered to a classifier. The screen product consists of 10 per cent plus 40 mesh, 50 per cent plus 120 mesh, and 40 per cent minus 120 mesh. The coarse-classifier discharge is handled on two roughing tables and the fines are handled on a third table. Part of the rougher table discharge is laundered to waste and part to two cleaning tables on a lower floor. All of the tables are of the Overstrom type. The concentrates from the tables range from 40 to 47 per cent tungstic acid. These are first cleaned to free them from copper and sulphide minerals and then shoveled from a settling tank upon a drier, heated by electricity. When dried, the concentrate is passed through a magnetic separator, the reject, iron and garnet, being rerun over the machine. Scheelite concentrates are finally cleaned by passing through a second magnetic separator of the Wetherill type. The final product is sacked as it comes from the machine. Twelve men are employed in the mill and three on the surface tram. The total number in mine and mill is forty. Total power requirement is about 700 hp. for both mine and mill and camp.

Operation at a high altitude in a mountain region is attendant with difficulties. The season extends from April to December. All supplies have to be packed over a steep trail, 4½ miles in length. The selection of machinery was limited to such sizes as could be taken apart and moved up a narrow horse trail. Availability of electric power simplified and cheapened operation. A substantial camp had to be provided as well as stables for the pack train animals. Lumber cut from mountain timber was used in the construction of the mill and other buildings. Autotrucks are used for transportation between the railroad at Poleta, near Bishop, and the road head at Pine Creek.

Labor turnover has been high. In spite of the real difficulties of the situation a profitable enterprise has been established. Acknowledgment of courtesies extended to me by the officials of the company is gladly made.



A series of cirques and bare granite ridges near the tungsten property

Bauxite Not Readily Concentrated

The concentration or beneficiation of loosely consolidated bauxite admixed with clay has been tried at some mines in the United States, notably in the Eastern field, using log washers, according to Robert J. Anderson in *The Mining Journal.* This practice is, however, now rare there. In Germany, ores from many small mines in Hesse have been washed at a central plant. The log washers which have been used for bauxite have been of rather crude design, consisting simply of two logs to which are attached flat metal plates arranged in spiral form. The ore is fed at the lower end and is moved forward and upward by the plates against a countercurrent stream of water, the lighter clayey impurities being removed by the washing. The log-washing method has been tried mainly to free the ore from stones, clay, and other admixed matter, chiefly derived from the overburden or the surrounding country rock in the case of pockets of ore. No method for the concentration of low-grade bauxites has been a notable success, although such a method is badly needed. A good beneficiation method would enlarge the output capacity of all the large mines, increase the supply of good ore, save the best ores, and enable operators to market materials now too poor to be used. It would also permit the working of many pockety fields, particularly in the eastern United States, and would be of great value in the Hesse district of Germany.

Considerable work has been done on the treatment of bauxite clays with a view to extracting the alumina, but none of these methods has yet become commercial. The Everhart process may be cited as one recently developed. This calls for separating the clay from bauxite by washing in the presence of small amounts of added peptizers. The process was designed to recover bauxite from two types of mineral hitherto not of commercial value: (1) deposits carrying granular high-grade bauxite mixed with clay, where the proportion of clay to bauxite varies from 2 to 1 to 7 to 1; and (2) deposits of low-grade bauxites and bauxitic clays, where the alumina content is about 45 to 50 per cent. The peptizers used in the Everhart process included sodium hydroxide and the more strongly absorbed sodium salts. The Everhart process was investigated by one of the large abrasive companies, and is said by the company to be of no particular value. However, possibly further investigation of the Everhart or some other process may solve the problem.

Work is being done by the U. S. Bureau of Mines on the removal of silica and other impurities from low-grade bauxites and clays, and the Georgia clays and inferior bauxites are being studied with a view to their utilization for refractory manufacture.

Iron-Ore Deposits of Cuba

Estimated to Contain Over Three Billion Tons in Six Principal Fields, the Mayari, Levisa, Moa, Santiago, San Felipe, and Pinar del Rio—Approximately 90 Per Cent Is Soft

By Olin R. Kuhn
Donner Steel Co., Buffalo, N. Y.

THE MOST IMPORTANT of the iron-ore deposits of Cuba are found on the eastern end of the island, in Oriente Province, at Mayari, Levisa, Moa, and Santiago, in the east central portion at Camaguey, and in the western part at Pinar del Rio. For over thirty-five years Cuba has been an exporter of iron ore to the United States, the annual shipments ranging from 500,000 to 1,500,000 tons. Practically the only operations at present are at the Mayari and Daiquiri mines, in Oriente Province. Mayari ore is hauled from the mines to Felton, on Nipe Bay, where it is dried, nodulized, and loaded into ships for export. Daiquiri ore is shipped from Santiago. Cuba has no iron industry, and practically all of the ore production is sent to furnaces in the United States.

Iron Ore Production of Cuba

Year	Juragua	Daiquiri	Mayari	El Cuero	Total
1884-1890	1,142,500	.....	.....	.....	1,142,500
1891-1900	2,348,500	.....	980,000	.....	(a) 3,349,000
1901-1910	2,104,200	.....	4,456,400	224,700	(b) 7,134,300
1911	355,100	252,700	387,800	168,100	1,163,700
1912	630,100	463,500	446,200	128,000	1,397,800
1913	369,200	571,300	491,700	130,200	1,582,400
1914	267,600	284,500	228,900	40,000	821,100
1915	215,000	245,600	300,900	65,900	827,400
1916	212,000	181,600	258,500	60,700	712,700
1917	39,800	181,00	287,900	44,800	553,500
1918	17,100	353,100	232,540	40,800	643,500
1919	.....	279,700	78,1000	.....	357,800
1920	.....	561,300	321,500	.....	882,800
1921	.....	130,400	.....	.....	130,400
1922	.....	444,800	.....	.....	444,800
1923	.....	674,400	.....	.....	674,400
1924	.....	.....	.....	.....	

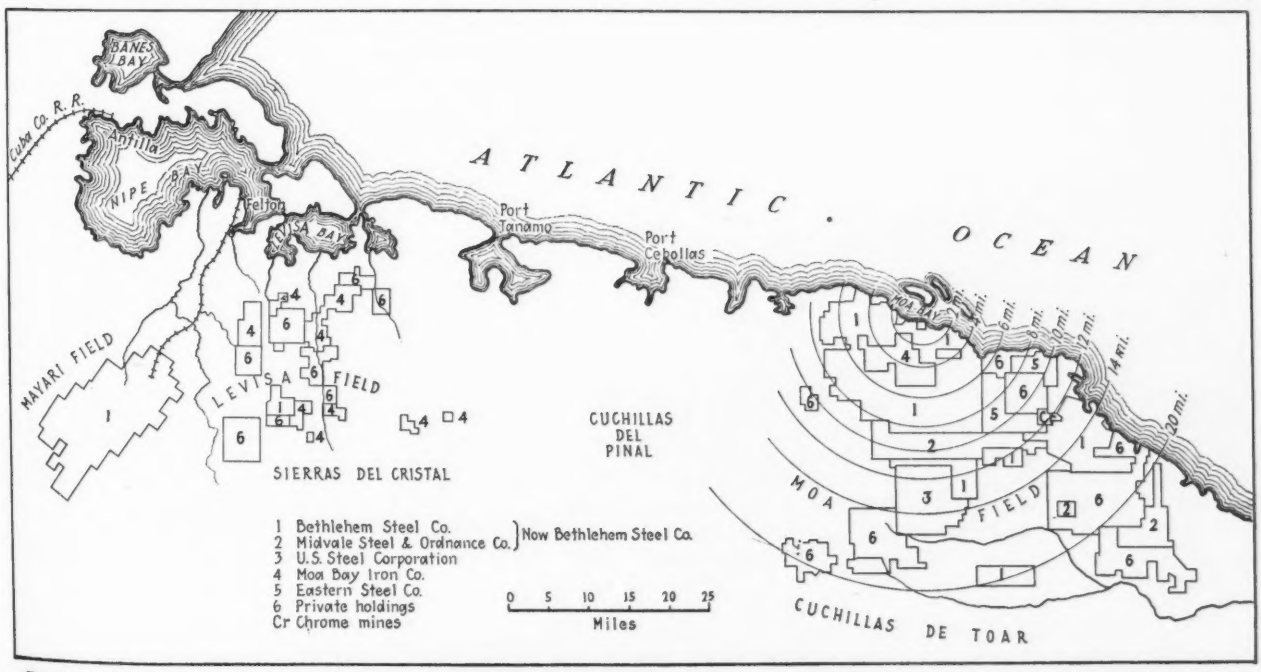
(a) Of the total 20,400 tons was from Sigua mine; (b) 41,200 tons from Guama mine.

Cuba holds an important place in any tabulation of the world's reserve of iron ore. It is estimated that it contains over 3,000,000,000 tons of available ore. Of this enormous tonnage nearly 90 per cent consists of soft ores of the north coast. Reserves of hard ore are found on the south coast near Santiago. About 90 per cent of the total reserve is owned by three steel companies

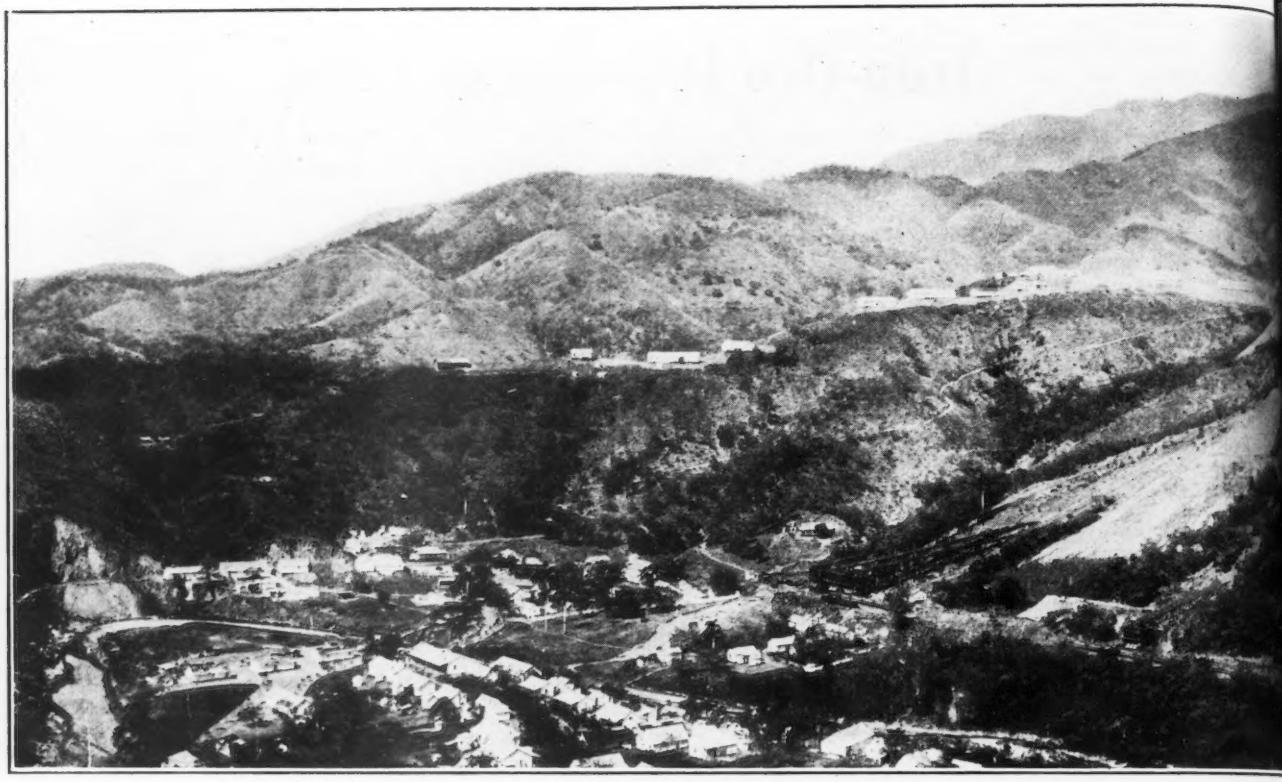
Outline map of Cuba, showing the location of the six most important iron-ore districts of the island

in the United States. Aside from the Mayari and Daiquiri mines of the Bethlehem Steel Corporation, none of the properties are being worked at present. The Bethlehem company alone, through its subsidiaries, the Spanish American Iron Co. and the Juragua Iron Co., controls over 80 per cent of all of the island's reserves.

A broad mountainous belt, underlain by serpentine, follows the north coast of Oriente Province from Nipe



Part of the eastern end of the Island of Cuba, showing the holdings of various interests in the Mayari, Levisa, and Moa iron-ore districts



Daiquiri iron ore mines of the Spanish American Iron Co., in the Santi trict,

Bay to Baracoa. Lateritic weathering of the serpentine has produced extensive surface blankets of residual iron ore. These blankets cover about 10 per cent of the serpentine area. They have accumulated here and there on more or less flat or gently sloping table lands; elsewhere erosion has removed them as fast as they have been formed.

There are three localities in Oriente Province where the topographic conditions have permitted extensive accumulations of ore. These are the Moa, Levisa, and Mayari fields. Between them are immense stretches of barren serpentine.

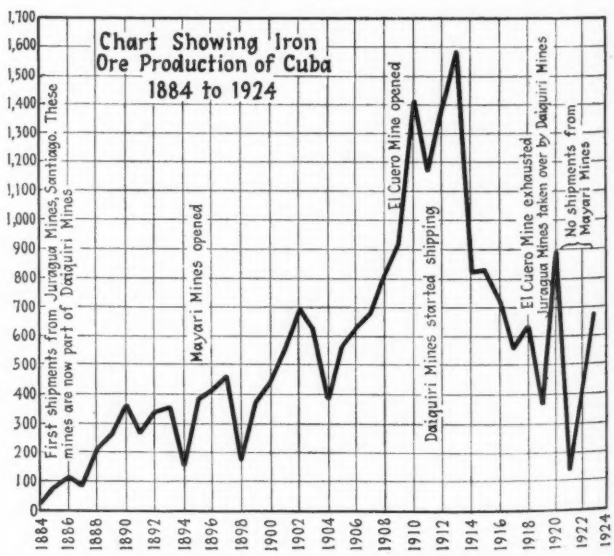
The ore blankets extend horizontally for several miles and vary in thickness from 1 to 100 ft. The average depth is from 15 to 25 ft., and there is absolutely no cover. The orebodies are usually covered by scrub pine forests or by tropical jungles, and all of the mining is done by quarrying or open pits. While the ores vary greatly from place to place, they all show essentially the same characteristics.

Deposits of soft ore similar to the ores of the north coast of Oriente Province occur also at San Felipe, in Camaguey Province, and in Pinar del Rio Province. These soft or lateritic limonite ores are high in both hydroscopic and combined water and alumina and are persistent in their content of nickel and chromium. The iron, silica, and alumina vary between wide limits. The Mayari field is the only one of this type of ore that is being operated at present. These ores, on account of their high water content, are dried and nodulized or sintered before they are shipped. The composition of the soft limonite is as follows:

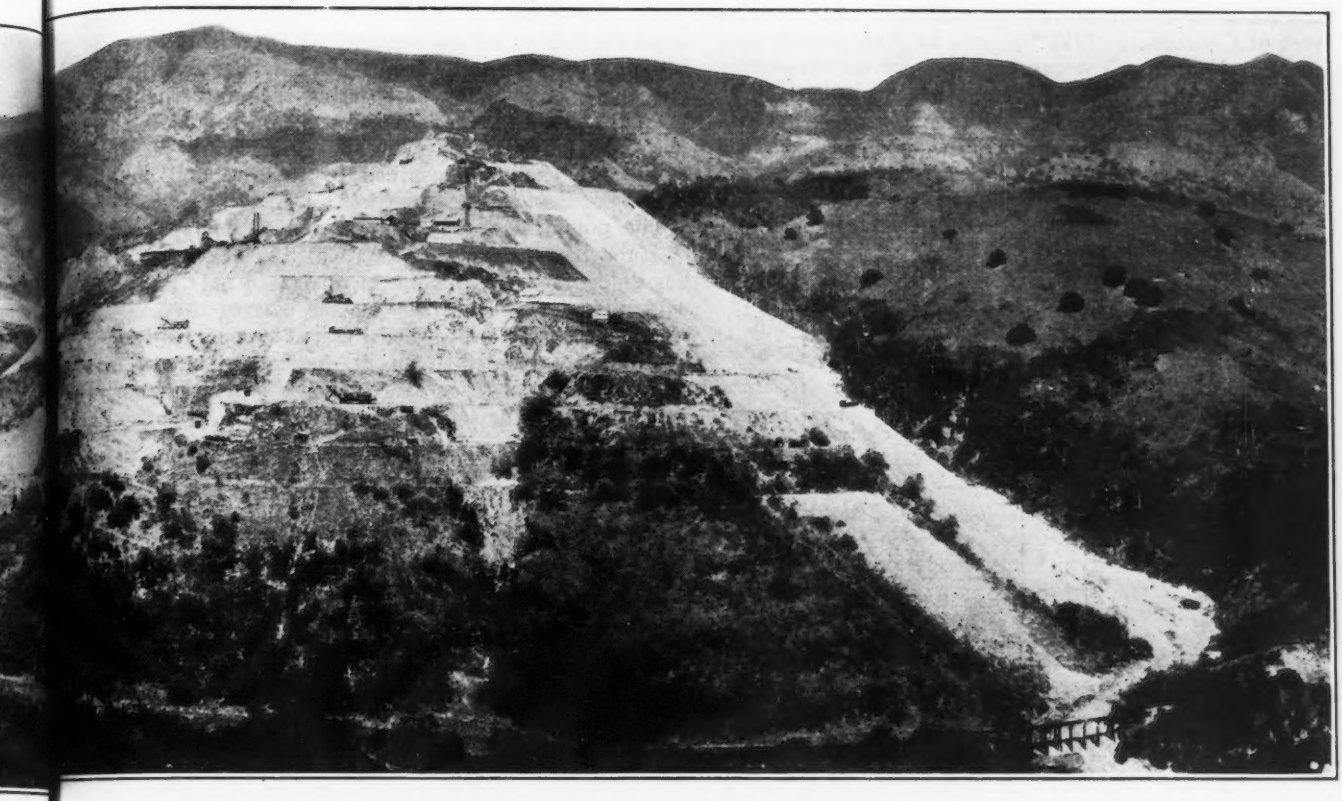
Iron, per cent	40.00 to 50.00
Silica, per cent	2.00 to 6.00
Alumina, per cent	6.00 to 14.00
Nickel, per cent	.50 to 1.00
Chromium, per cent	1.50
Phosphorus	Low
Sulphur	Low

The only deposits of hard ore are near Santiago de Cuba at Sevilla, Firmeza, Daiquiri, and Berraco. These ores are a mixture of hematite and magnetite and contain from 55 to 65 per cent iron, 7 to 12 per cent silica, 0.3 to 0.9 sulphur, and are below the bessemer limits in phosphorus. The orebodies are generally found on the sides of high hills or mountains, and the ore is mined by quarrying. The Daiquiri mines only are being worked.

Moa Field.—In the Moa field is by far the largest body of iron ore in Cuba. The district is in the province of Oriente immediately south of Moa Bay. In many places the ore reaches down to the water's edge. The field stretches 12 to 15 miles inland and is possibly 30 miles



Curve of the iron-ore production of Cuba, 1884 to 1924 expressed in thousands of tons



Santiago district, Cuba. **These are the only properties now operating in this section**

wide. Of course this entire area of about 400 square miles is not covered by iron ore, although well over half of it is under claim. These claims, however, include a great deal of barren territory. There are also large areas of very lean ore, averaging about 30 per cent in iron. The ore, as stated before, is a lateritic limonite derived from the underlying serpentine rock. Following are typical analyses of the rock and the ore.

	Serpentine Rock	Moa Iron Ore
Iron, per cent	5.00	45.67
Silica, per cent	39.80	6.26
Sulphur, per cent	.....	.107
Phosphorus, per cent	.....	.008
Magnesia, per cent	33.69	.....
Alumina, per cent	1.39	10.64
Chromium, per cent	.20	1.96
Nickel, per cent	.97	.85
Combined water, per cent	.....	11.59

The claims in this district are held largely by four companies, and the reserve is estimated to be about 2,000,000,000 tons of ore, three-fourths of which will average over 40 per cent in iron. The holdings in the Moa field are as follows:

Holding company	Acres	Reserve, Tons
Bethlehem Steel Corporation	98,340	1,470,000,000
United States Steel Corporation	15,000	210,000,000
Eastern Steel Co.	10,188	50,000,000
Moa Bay Iron Co.	7,152	155,000,000
Miscellaneous holdings	50,000	100,000,000
Total	180,680	1,985,000,000

Although the Moa field has never been developed, it has been well explored. The ore runs from 41 to 49 per cent in iron. It is similar to the Mayari ore, though not quite as high in grade.

Levisa Field.—Levisa field lies west of the Moa district on Levisa Bay about 15 miles east of Nipe Bay. Its ore is similar to that of the Moa field. The Moa Bay Iron Co. owns a great deal of this field, and the reserve is estimated to be about 75,000,000 tons of ore averaging over 45 per cent iron. As in the Moa field, there has been no development in this district.

Mayari Field.—Mayari field lies southwest of the Levisa field about 15 miles south of Nipe Bay and covers nearly 40,000 acres. This district is entirely owned by the Spanish American Iron Co. and is the only one of the soft-ore districts that is being worked. Reserves here are put at 600,000,000 tons of soft brown ore, 90 per cent of which will average over 40 per cent in iron. The ore is soft and clay-like and offers an ideal material for machine mining, and most of it is taken out by drag-line excavators. The mines are all high in the mountains and the ore is carried to the base by inclines. On account of the high water content, from 25 to 35 per cent, this ore is dried and nodulized at Felton, on Nipe Bay, before it is shipped to the United States. Most of the Mayari ore shipped to this country is consumed by the Bethlehem Steel Corporation's furnaces at Sparrow's Point and at Bethlehem. Pig iron made from the ore averages about as follows:

	Per Cent		Per Cent
Silicon	0.75 to 2.75	Chromium	2.00
Phosphorus	.08	Titanium	.20
Sulphur	.04	Vanadium	.08
Manganese	.70	Carbon	(a) 4.25
Nickel	1.00		

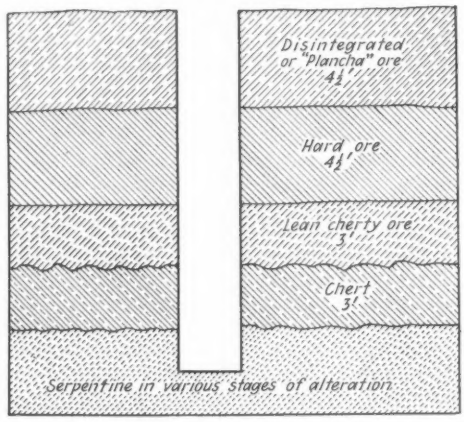
(a) Depending on the silicon

The mines in the Mayari field have shipped as much as 491,700 tons in one year and the plant at Felton has a capacity of 500,000 tons of nodules annually, but there has been little production in recent years. Analyses:

	Mayari (Crude) Per Cent	Mayari (Nodules) Per Cent
Iron	46.03	55.00
Silica	5.50	4.50
Alumina	10.33	13.00
Manganese	.56	....
Phosphorus	.10	.04
Sulphur	.06	Tr.
Chromium	1.70	2.00
Nickel	.50	1.00
Combined water	13.63	....
Moisture	31.63	....

San Felipe Field.—San Felipe or Cubitas field is

in Camaguey Province in east central Cuba, 14 miles west of Camaguey. Like the ores at Moa and Mayari, the San Felipe ores occur as a mantle on serpentine and usually occupy the flat tops of the hills. These ores are similar to the Mayari and Moa ores, but are inclined to be slightly higher in phosphorus. This entire field, nearly 60 square miles, is controlled by the Bethlehem Steel Corporation, and it is estimated that it contains about 400,000,000 tons of 40 per cent ore and



Ideal section of test pit in the San Felipe district

50,000,000 tons of 45 per cent ore. Although this field has never been developed it is known that the ore will average about as follows:

	Per Cent		Per Cent
Iron	45.18	Lime and magnesia	2.00
Silica	6.75	Chromium	1.70
Alumina	12.30	Nickel	.53
Phosphorus	.10	Ignition loss	12.00
Sulphur	.06		
Manganese	.56		

Pinar del Rio Field.—Pinar del Rio field lies in western Cuba, and the ore is similar to that in Oriente and Camaguey provinces, averaging about 40 per cent in iron. Reserves of this field are estimated at about 40,000,000 tons, but aside from exploration practically no development has been undertaken in this district.

Santiago Field.—Near Santiago, on the southeastern coast of Cuba, is the only district on the island where hard ore has been found. This ore is hematite and magnetite averaging from 55 to 65 per cent in iron and low in phosphorus. The chief workings have been at Sevilla, Firmeza, Daiquiri, and Berraco, but the Daiquiri mines of the Spanish American Iron Co. are the only ones now operating. The orebódies are found on the sides of the mountains in diorite, and the ore is mined by open cuts along the sides of the mountains and taken down to the railroad by inclines. The Lola, Magdalena, and Barcelona mines comprise the Daiquiri group. These have produced as much as 674,371 tons of ore in one year (1923). Following is an analysis of the ore that was shipped from the Daiquiri mines from 1896 to 1907:

	Per Cent		Per Cent
Iron	57.40 to 63.10	Manganese	.06 to .10
Silica	7.20 to 11.80	Alumina	.70 to .80
Sulphur	.05 to .20	Lime	.90 to 1.10
Phosphorus	.02 to .04	Magnesia	.30 to .40

These ores occur in irregular-shaped deposits associated with schists and crystalline limestones. On account of the irregularity of the deposits, estimates of reserve tonnage should be accepted with caution. Hayes, however, credits the Santiago district with approximately 9,000,000 tons of ore, of which about half has been definitely proven by drilling.

Total reserves of iron ore for the Island of Cuba total over three billion tons, which represents over one billion tons of metallic iron. This tonnage, while it is enormous, is based on prospecting including thousands of drill holes, and since the ore lies as a surface blanket with absolutely no covering, the horizontal measurements are easily determined by drilling and sinking pits.

The potential or possible reserve of low-grade ores of Cuba has been placed at about 12,000,000,000 tons, but of course this tonnage is estimated only and is in no way proven. Since the greater part of the iron-ore reserves of Cuba are owned by steel companies located in the United States, it is only logical to suppose that Cuba's enormous reserve of iron ore will be consumed by furnaces in the United States.

Iron Ore Reserves of Cuba

District		Controlled by	Kind of Ore	Tonnage
Oriente Province	—Mayari	Bethlehem Steel Co.	Soft ore	600,000,000
	—Levisa	Moa Bay Iron Co.	Soft ore	75,000,000
	—Moa	Bethlehem Steel Co.	Soft ore	1,470,000,000
		Moa Bay Iron Co.	Soft ore	155,000,000
		United States Steel Corporation	Soft ore	210,000,000
		Eastern Steel Co.	Soft ore	50,000,000
		Miscellaneous	Soft ore	100,000,000
		Total Oriente	Soft ore	2,660,000,000
	—Daiquiri	Bethlehem Steel Co.,	Hard ore	9,000,000
		Total Oriente Province		2,669,000,000
Camaguey Province	—San Felipe	Bethlehem Steel Co.	Soft ore	450,000,000
Pinar del Rio	—Pinar del Rio	.....	Soft ore	40,000,000
Total reserve of Cuba				3,159,000,000

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"Notes on Certain Iron Ore Reserves of the World." C. M. Weld. 1918.

"Iron Ores—Foreign America." Imperial Mineral Resources Bureau, London. 1922.

"Our Iron Ore Imports Are Increasing." P. M. Tyler. 1924.

"Mayari Pig Iron." Bethlehem Steel Company. 1920.

"Iron Ores." E. C. Eckel. 1914.

Engineers' reports on various properties in Cuba.

Silver Production in Idaho Less in 1925; Value Greater

Idaho's silver production in 1925 was 65,808.45 oz. less than in 1924, but its value exceeded that of 1924 by $132,124.62. The 1925 output was 7,708,938.55 oz., valued at $5,324,178.41, as compared with 7,774,747 oz., valued at $5,192,053.79, in 1924. The average price of silver in 1924 was $0.66781 per ounce, and in 1925 it was $0.69065 per ounce.

The largest producers in the Coeur d'Alene district were: the Bunker Hill & Sullivan Mining & Concentrating Co., the Morning mine of the Federal Mining & Smelting Co., the Hecla Mining Co., the Gold Hunter Mines, Inc., the Tamarack & Custer Consolidated Mining Co., the Hercules Mining Co., and the Sunshine Mining Co.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief. Letters will not be printed unless the author's name and address are known to the editor.

Government Publications and the Leadville Report

THE EDITOR:

Sir—There is little or no reason to differ with your editorial on "Delay in Government Publications," which appeared in the *Engineering and Mining Journal-Press* of March 20. Anyone who has undertaken the preparation of a monographic report similar to the Geological Survey's Professional Papers on mining districts can thoroughly sympathize with your statement. Even under ideal conditions the preparation of such a report is a time-consuming operation, and the fact that such a report, when prepared, cannot have a continuous right-of-way through the channels of editing and publication further adds to the time that must elapse before parties eagerly waiting for the report can obtain it. It is not the easiest thing in the world to strike at once the proper balance between one part and another of these monographic reports, and strenuous effort to hurry their preparation may result in poor work or at least poor presentation of good work. This remark does not, however, excuse undue deliberation on the part of authors.

As you specifically mention the Leadville report, of which I am the one surviving of three authors, you may be interested to know that a short bulletin (No. 779) entitled "Guides to Ore in the Leadville District," has passed page-proof stage, but judging from past experience its publication may be expected in two or three months. The complete Leadville report (Professional Paper 148) is finished and will go to the printer this month.

G. F. LOUGHLIN,
Geologist in charge,
Section of Metalliferous Deposits.

Washington, D. C.

The Mosul Question

THE EDITOR:

Sir—Some time ago I wrote to you protesting against what seemed to me the rather dogmatic tone of some of your editorials on the Mosul question. You replied courteously, explaining that you knew whereof you wrote, or to that effect.

Therefore I think it will interest you to know that, replying to criticism in the debate on the Anglo-Iraq Treaty in the British House of Commons on Feb. 18, Sir Austin Chamberlain said that in March, 1925, he was approached by the Turkish representative with a suggestion to settle the Mosul question apart from the League of Nations. The Turkish proposition (as reported in the papers) was that Turkey should have as much of the Villayet of Mosul as she wanted (it is only a small part of Iraq), in return for which a British company, approved by the British government, should have the exploitation of all the oil with any other concession that it desired.

Had the exploitation of the oil fields (presumed to exist) been their object, is it likely the British Government would have risked international complications at such a critical time by holding out for a boundary for a country that is only temporarily subject to their suzerainty, when all the oil was offered indefinitely (for all practical purposes), not to Iraq but to themselves? Most people do not seem to realize that it was a dispute between Iraq and Turkey in which the British Government represented Iraq.

I do not doubt your sincerity for an instant, but I do think that the propaganda carried on was very successful in misleading many people of sound judgment.

El Paso, Texas. C. B. E. DOUGLAS.

Mexican Policies

THE EDITOR:

Sir—Referring to the editorial on p. 514 in your issue of March 27, 1926, relative to mineral property rights in Mexico, is not the question at issue rather a simple one? It would seem that no one could deny the Mexican Government, or any other government, the right to pass such legislation as it might choose to pass, within the limits of its own constitution, relative to the acquirement of mineral rights by citizens of its own or foreign countries. The government of the United States has reserved from entry such mineral lands as it wishes to reserve, and the states have passed such laws as they cared to pass, within the constitutions of the states and of the federal government, relative to the ownership of lands; but it has not come to the attention of the writer that any such laws have been passed which affected or aimed to affect interests already acquired by anyone.

Mexico's policy, relative to the development of its minerals in the future, is her own, and no one can deny her this right. There are many of us who believe that no important mineral development will ever take place south of the Rio Grande and north of Brazil which is not financed by foreign capital and directed by foreign management and initiative. Some well-informed engineers and financiers would extend this opinion down to Tierra del Fuego. This opinion may or may not be right, but if the countries owning natural resources prefer to hold these resources undeveloped, or to develop them only as they are able themselves to do, that is apparently their privilege.

The question at issue in Mexico, as the general public sees it, is the question of whether rights acquired already, in Mexico, shall be subject to arbitrary legislation of a confiscatory nature, or to taxation and other measures which come to the same thing. The greater part of the developed mineral and oil resources of Mexico seem to have been developed by foreign capital, and legislation which seeks to divert such property from its foreign owners, without due compensation, or which

seeks to prevent or obstruct the operation of such property by its foreign owners, would apparently be both ethically wrong and practically indefensible.

There are foreign interests operating in the United States in various businesses, and any attempt on the part of the United States to legislate so as to destroy or divert to American ownership, without due compensation, any of these foreign-owned industries would meet with strenuous and probably successful opposition from abroad. The only case the writer knows of of this sort would be the various enemy-alien industries which were confiscated as a war measure, and which are slow in being restored, largely because of the insolvency of the foreign governments involved. Except as a war measure, it seems generally accepted that existing foreign industries are not to be confiscated or obstructed by any nation. Are not the troubles of Mexico and of the Soviet government, both of them, largely due to the attempt to divert to the state assets which have been mainly developed by foreign initiative and capital? If this is not the point at issue in Mexico, the writer would be glad to be informed what really is at issue. So far as he has heard, there has been no attempt on the part of anyone in our government to dictate to Mexico what its policy shall be as to the undeveloped and unowned mineral resources.

Many nations have encouraged the entrance of foreign capital for the development of their natural resources. Without foreign capital, the second half of the nineteenth century in the United States would have been vastly less progressive. Those nations which attempt, as prosperity is created by foreign initiative and capital, to confiscate the fruits of such development have always led a stormy and unprofitable career. South Africa is probably as interesting an example for Mexico to consider as any which can be adduced. The conduct of the Russian Government toward industries such as the British and American copper developments is another instance in point. This sort of conduct has ruined the credit of all nations engaging in it, and has resulted in the extinction or conquest of the smaller nations which entered upon this sort of career. Is there any reason to expect history to reverse itself in the future? STEPHEN ROYCE.

Crystal Falls, Mich.

Operation of the Blue-Sky Law in California

THE EDITOR:

Sir—In your issue of Jan. 23, 1926, there appeared on pages 171, 172, and 173 an article headed "The Prospector and the Blue-Sky Law." It is over the name of Harold Lee Gage. While the criticisms it contains are directed particularly against the blue-sky supervision of another state, they are sufficiently general in character to warrant comment on behalf of California. This comment, it seems to me, is particularly called for, as the article in question apparently is in line with a generous supply of attacks that has been rampant of late on the part of those who desire to have absolute freedom in mining promotions.

My particular exception is taken to that portion of the article in the third column under the sub-heading "Incorporation Statutes Should Be Uniform." In the first paragraph under that heading Mr. Gage says, in part: "Therefore, the prospecting fraternity advocates the allowance of 10 to 20 per cent of the stock issued to the prospector in payment for his property to himself in person," etc.

Speaking for California, let me say that Mr. Gage and others who make such statements are misinformed. In this state, promoters of mining ventures have been and will continue to receive a maximum of 50 per cent of the par value or number of shares issued, where the showing of the company warrants it. This is in addition to a selling expense allowed of 20 per cent.

California is and has been escrowing stock, and probably will continue doing so, to insure proper financing of mining properties, and I cannot believe any promoter with the interest of stockholders at heart would object to this rule.

I am enclosing a copy of the Commissioner's instructions to deputies, and respectfully call your attention to Rule XI relating to commissions and Rule XII dealing with promotion stock. These rules are not for publication, but for your information and in support of the statements given above.

It is not my intention to enter into a controversy with any person who believes mining ventures should have freedom from state control so far as stock-selling activities are concerned. Also, it is and has been the desire of the California Corporation Department to encourage legitimate mining enterprises, and this policy will continue. EDWIN M. DAUGHERTY,
Commissioner of Corporations.

Los Angeles, Calif.

The Stanfield Mineral Land Bill

THE EDITOR:

Sir—The bill of Chairman Stanfield of the Senate Public Lands Committee, requested by the Secretaries of Agriculture and of the Interior, if passed, would cause the prospector to fire his farewell shot, throw down his pick and shovel, dispose of his faithful pack animal, and retire into the unknown. Henceforth the mining industry would be at a standstill in regard to new sources or discovery of mineral. The principal part of the public lands of the United States lies in the western, northwestern, and southwestern parts of the country, and in the timbered areas, as here in the Northwest, they are subdivided into numerous forest reserves, which are under the supervision of the Forestry Service of the Department of Agriculture. Here in the Northwest practically all the public lands are within these reserves. The Stanfield bill would confer no surface right except to the mineral in the earth. The prospector or mine operator would be allowed only sufficient ground for his buildings, the location of which might be optional with the forest officer. All timber used in mining or prospecting would have to be accounted for, and payment made to the Forest Service. If a stream of sufficient size should flow across claims and be desired for power, it could not be used, according to the bill.

It is my hope that, through a publication in your valuable journal and other publications, and by advising our Representatives to vote against this bill, we may be able to defeat its passage. If not defeated the bill will hinder the mining industry in years to come. No doubt, in some instances, the present mining laws have been abused, and fake claims have been filed for purposes other than legitimate mining; but the Forest Service has ample power to take care of such occurrences under the present laws. W. O. TEMPLEMAN.

Troy, Mont.

Consultation

Bond and Lease on Mining Property

"Can you supply me with a simple form of contract for the bonding and leasing of gold- and silver-mining property? I should like to use it as a guide in drawing up papers of this kind."

A typical form for such an agreement is shown below. It should be acknowledged before a notary or other proper official and may be recorded to meet the requirements of the locality.

Mining Lease

This indenture, made this ..... day of .....A D., 19..., between ....., of ....., lessor, and ....., of ..... lessee;

Witnesseth: That the said lessor, for and in consideration of the royalties hereinafter reserved, and the covenants and agreements hereinafter expressed, and by the said lessee to be kept and performed, ha.. granted, demised and let, and by these presents do .. grant, demise and let, unto the said lessee, all the following described mine and mining property, situated in ..... mining district, county of ....., State of ....., to wit: (Here follows description) ..... Together with the appurtenances to have and to hold unto the said lessees for the term of ..... from the date hereof, expiring at noon on the ..... day of ..... 19.., unless sooner forfeited or determined through the violation of any covenant hereinafter against the said tenant ..... reserved.

And in consideration of the said demise the said lessee does covenant and agree with said lessor as follows, to wit: To enter upon said mine or premises, and work the same in the manner necessary to good and economical mining, so as to take out the greatest amount of ore possible, with due regard to the development and preservation of the said premises as a workable mine, and to the special covenants hereinafter reserved. (Here insert special conditions and agreements of lease, work to be done, and other data.)

In Witness Whereof, the parties have here unto set their hands and seals the day and year above written.

Signed, sealed, and delivered in the presence of: .....(Seal) .....(Seal) .....(Seal)

.....

Frequently, a lease and option, also known as a working bond, is preferable. At the end of the mining lease above outlined, and preceding the final paragraph, the following provisions may be inserted:

And in consideration of the foregoing lease and the expenditures to be made thereunder and the well and faithful keeping of the covenants thereof, the said lessee shall have the right to purchase the said premises together with all improvements, etc., for the sum of ..... dollars ($.....) to be distributed in the following payments: On or before the ..... day of ..... 19.., the sum of ..... to be paid (designate manner and place of payment), and on or before the ..... day of ..... 19.., the sum of ..... (Here insert conditions of payment.)

Time being of the essence of this contract as to such payments, and upon the tender of such payments the lessor will execute, acknowledge, and deliver at his own cost, good and sufficient deeds to the lessee, or such person or such company as the lessee shall nominate, conveying the said premises clear of incumbrance. (Deeds to the property are generally placed in escrow with some bank or responsible party, to whom payments are made when due under the agreement, and who delivers the deeds when payments are completed.)

The forfeiture, surrender, or termination of the above lease for any cause shall render the option void, and the above mentioned payments may not thereafter be tendered.

It is expressly agreed and understood that this agreement shall be considered as an option to purchase only, and not as obligating the said lessee to purchase said property.

Oxygen-Enriched Air in Metallurgy

"Can you tell me if any work has recently been done concerning the application of oxygen-enriched air in metallurgy"?

The U. S. Bureau of Mines started an investigation of this subject about four years ago, and in the middle of 1923 issued a preliminary report (Reports of Investigations, Serial No. 2,502), which pointed out the benefits it was believed would result from the use of oxygen or oxygen-enriched air if oxygen could be produced at a reasonable cost per ton. As was stated in this preliminary report, the next phase of the Bureau's work on this subject would be to endeavor to determine whether or not the oxygen could be produced at a cost approximating $3 a ton. At present, it is expected to be able to present a paper or report at the February, 1927, meeting of the American Institute of Mining and Metallurgical Engineers, on the status of the work at the close of the present calendar year.

No other work of this nature is being carried on, on any important scale, so far as known.

Tax on Mexican Mining Claims

"Can you explain the method of taxing mining claims in Mexico?"

At the time of issuance, of title, a tax of 10 pesos for each claim or fractional part of a claim is imposed, to which 1 peso is added as a surtax of 10 per cent for the public debt. Subsequent annual taxes are as shown in the table below, furnished by the Chamber of Mines of the State of Chihuahua. These rates became effective Jan. 1, 1924.

Annual Tax on Mining Claims

Claims	Mining Tax Pesos	Public Debt, Pesos	Total, Pesos
From 1st to 5th	6.00	0.60	6.60
From 6th to 50th	9.00	0.90	9.90
From 51st to 100th	12.00	1.20	13.20
From 101st upward	18.00	1.80	19.80
For Each Period of Four Months			
From 1st to 5th	2.00	0.20	2.20
From 6th to 50th	3.00	0.30	3.30
From 51st to 100th	4.00	0.40	4.40
From 101st upward	6.00	0.60	6.60

The progressivity of fees will be applicable provided the claims belong to a single party and are situated within the same municipality.

If payment is made the second month of the period a 10 per cent increase is assessed; if made in the third month a 25 per cent and if in the fourth a 50 per cent. In case the four months pass away and payment is not made, the Department of the Treasury and Public Credit may decree the caducity of the right of ownership.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

DECLINE of gold production in the United States stimulating research for reducing costs and utilizing lower grade ores—Radio uses 5,000 tons of copper per year.

Carson Investment Co. sues Nevada Consolidated Copper Co.—Action to collect assessments on South Lake stock—Tariff on copper stressed—Potash bill meets opposition.

Railroad from Crown King mine, Ariz., abandoned—Tin a byproduct at Consolidated Mining & Smelting Co. of Canada.

International Nickel begins extensive development program—McIntyre mills 1,400 tons per day—Dome ore averaged $7.70 per ton during March.

Callahan Zinc-Lead moves main office from New York to Wallace, Idaho, and elects new officers—Tamarack & Custer finds new orebody—Montana-Idaho Copper leases mine near Winston, Mont.

Noah Timmins, of Hollinger company, controls large acreage adjoining Noranda at Rouyn—Nipissing has reserves of 1,000,000 oz. of silver.

California mines report new ore discoveries, the most spectacular of which is at Kramer.

Calumet & Hecla installs vertical water column and electric conduit 5,300 ft. long.

France approaching pre-war mineral production, especially in potash, phosphate, and iron.

Anaconda builds new timber mill at Rocker, Mont.

Decline of Gold Production in West Concerns Members of Congress

A campaign intended to arouse interest in increasing domestic gold production is well worth while, in the opinion of Scott Turner, Director of the Bureau of Mines. Western members of Congress are much concerned over the slump in gold production. In 1915 the refinery production of gold was in excess of $100,000,000. In the calendar year just closed production was less than half that amount, with all indications pointing to further decreases in production in the future unless something is done.

In the ten years preceding 1915 there was only one year in which production of gold dropped below $100,000,000, but since 1915 the trend has been downward as these figures show:

Production of Gold Calendar Years 1915-1925

Year	Value	Year	Value
1915.....	$101,035,700	1921.....	$50,067,300
1916.....	92,590,300	1922.....	48,849,100
1917.....	83,750,700	1923.....	51,734,000
1918.....	68,646,700	1924.....	50,570,297
1919.....	60,333,400	1925.....	49,126,900
1920.....	51,186,900		

The desire is to work out a program of stimulation which can be presented to the Bureau of Mines, which if approved could be used to justify an estimate for the forthcoming budget.

The principal hope lies in reducing the costs of treating low-grade and rebellious gold ores. It also is recognized that Alaska has great potentialities as a source of gold production. The plans include studies of steps that may properly be taken by the government to encourage more capital to enter upon the development of gold properties in Alaska and to encourage the more thorough prospecting of that territory.

Gold Discovery at Kramer, Calif.

SOUTHEAST of Kramer, in San Bernardino County, Calif., John Herkelrath and his brother recently made a gold discovery in sections 35 and 36 of Township 10 north, Range 6 west, San Bernardino meridian. A vein was uncovered which panned gold in sufficient quantity to be called high grade, according to local reports. A mild "gold rush" is under way.

Prospectors, mining men, engineers and those merely curious have flocked to Kramer. The Kramer Hills were dry placered in a number of places for a long time, and some efforts were made to explore leads, but nothing of importance was found, although the dry washers usually made sufficient to encourage them to continue. Apparently the discovery of the Herkelrath brothers is in an area which escaped close attention and has now proved to be interesting.

Mono Starts New Cyanide Mill

The Mono Mining Co. has started its 100-ton cyanide plant at its Silverado mine, near Sweetwater, Nev. Construction was completed in December last, but operations were delayed because of lack of power for both mine and mill.

A 150 hp. Diesel engine has been purchased for additional power, and with the electric power plant on Green Creek now furnishes sufficient power for all immediate needs. The mine has sufficient ore exposed to keep the mill running for several months.

Constitution Mining Co. May Build Railroad in Lieu of Aërial Tram

The Constitution Mining & Milling Co., of Spokane, Wash., has abandoned the construction of an aërial tramway 7 miles long to deliver concentrate from Pine Creek, in the Coeur d'Alene district, to the railroad at Kellogg, Idaho. While maintaining shipments by motor truck to the railroad, important development plans will be carried out with the view to increasing proved ore reserves, the result of which will have an important bearing upon the final decision respecting permanent transportation. It is regarded as probable that the Constitution company will ultimately decide to build its own railroad rather than a tramway. A railroad of the logging road type could, according to estimates, be built for much less than the tramway and would give more satisfactory service. Such a railroad would also serve other mines.

In February the Constitution shipped 1,000 tons of concentrate, and this output will be increased, upon completion of additions now being made to the mill.

Boulder Sampler Shows Increased Mining in Colorado

In 1924 the Boulder Sampler at Boulder, Colo., paid out $50,000 for tungsten ores, while this figure in 1925 was trebled. In 1924 a total of $18,500 was paid out for other ores; in 1925 the amount was $84,000. More than $100,000 in equipment has been shipped into the Bonanza district, San Luis Valley, and it is expected that by June 1 500 men will be employed. At Salida, Colo., a 300-ton ore mill is being rebuilt and will be ready by June 1.

Vertical Water Pipe and Electric Conduit 5,300 Ft. Long

The longest vertical water line and electric conduit in the world are those just completed in Calumet & Hecla Consolidated's No. 5 Tamarack shaft in the Michigan copper country. The shaft, which is more than a mile deep, will be used for pumping purposes, draining the bulk of the water from the conglomerate and Osceola lode departments.

Column pipe and conduit required special construction. The column pipe, through which the water will be pumped to surface, is linked together by expansion joints to guard against extremes of temperature, and it is anchored to the shaft at intervals to distribute the weight. The column is constructed of 7½-in. pipe of rust-resisting iron. There are larger column pipes than this, for heavier service, but none of such great vertical length. The conduit carrying the electric wires to the pumps is securely sealed to prevent the seepage of water into it.

Water will be pumped from the bottom of the shaft, about 5,300 ft., vertically. A battery of three electric pumps will raise 1,000 gal. per minute to the 24th level, about halfway to surface, and from there another battery of three pumps will deliver the water to surface.

Lead Mining at Linn Creek, Missouri

Reports are that Linn Creek, Mo., is experiencing a mining boom. At the Claypool mines, four miles east of the town, more than 200 tons of lead ore was exposed by a blast which displaced 200 ft. of the face of a bluff. That mine and several others are operated by the Nixon-Thompson Co. The company will soon install two new mills. There are about 5,000 tons of ore on the ground. The Nixon-Thompson Co. has leased 14,000 acres in the vicinity of Linn Creek. Three other mining concerns are in the field.

Linn Creek is now facing the prospect of being covered with forty feet of water when the dam of the Missouri Hydro-Electric Power Co. near Bagnell, Mo., is completed, which will necessitate moving the town to the hills.

Mining in Northern California

At Nevada City, Calif., the Nevada City Consolidated Mining Co. has about completed a mill. The company reopened the New England shaft near Nevada City, and is reported to have discovered ore in old workings and to have extended exploration with success. The Mohican and adjoining claims have been acquired. At the Alcalde, west of Grass Valley, refinancing is said to have been completed and preparations are being made to resume sinking in the 1,500-ft. incline shaft. An ore strike is reported on the Buffington claims west of Nevada City, at which a five-stamp mill was recently completed. A compressor has been installed at the Merrifield mine, which is under lease and bond and at which a five-stamp mill is being operated on one shift per day.

The Alice Bell and Lone Star claims in the Willow Valley district are being operated by leasers, and plans are in contemplation for the removal of part of the milling equipment of the Murchie mine. The Alta Combination Mines Co. is operating the Baltic gravel mine, and has secured additional mining claims adjacent to the Baltic. An air compressor has been installed by the El Dorado County State Products Co. at its state quarry near Placerville.

Mining Activities in Southern California

Although there are several mining districts in southern California, some of them have been dormant or almost dormant for a number of years. In the Rosamond district, 15 miles southwest of Mohave, the Tropico, Piute, and the Old Hogie prospects are being explored. The Old Hogie is producing ore, which is being milled in the Tropico mill. In the Soledad district the Gold Town Mining & Milling Co. is operating a twenty-stamp mill. Near Anaheim the Blue Lights silver mine, in Silverado Canyon, is being developed, and it is reported that ore has been cut on the 700 level. A small production was made in 1925. A zinc pigment plant is being erected at Anaheim by the California Zinc Pigment Co. Sufficient zinc ore can be obtained to meet the plant capacity.

In the Randsburg district, the California Rand continues to be the most important mine in operation. The Atolia tungsten mine is being operated by leasers. Yellow Aster, King Solomon, Butte, and Windy are in operation, each, with the exception of the Windy, operating its own mill. The St. Elmo, at Atolia, is preparing to resume exploration operations, and a number of smaller prospects have exploration work in progress. The Yellow Dog is exploring its holdings, but the Standard is idle. The Amelia-Lorain, east of Caliente, in central Kern County, and various small properties are being worked. It is reported that the Zenda, Oregon, and Barbarossa prospects are preparing to resume.

In San Diego County the Golden Chariot is the only mine in operation. A Diesel power plant is being installed, and development is to be extended. In November, 1925, the mill of the Lone Pine Mining Co. was destroyed by fire, and it has not yet been reconstructed. On Catalina Island the Wrigley interests are developing a lead-zinc prospect and have made ore shipments.

Railroad from Crown King Mine Abandoned

The Crown King branch of the Santa Fé R.R., built several years ago to furnish transportation for ores from the Crown King mine, in Yavapai County, Ariz., is to be dismantled. The branch, 12 miles long, is one of the most famous pieces of track in the United States. The mine is at the top of Crown King Mountain and in making the ascent there are fifteen switchbacks, twelve trestles, and several tunnels. The grade is about 6 per cent. The Arizona Corporation Commission has given the company permission to abandon and dismantle the line.

Suit to Collect Assessments on South Lake Stock

The Michigan Supreme Court probably will be called upon to finally decide the action brought by the South Lake Mining Co. against stockholders in Houghton County to collect the balance due on an assessment of $2 per share called March 4, 1920, payable March 22, 1920, by shareholders of record March 20 of that year. Much interest is being taken in the Michigan copper district in the proceedings, as it is the first time action has been started under the Michigan statutes to collect assessment money on forfeited stock, which, no matter what the outcome, will establish a precedent.

Michigan law permits a company whose stock is assessable to sue the stockholder of record for the amount of the deficiency in case forfeited stock is sold by the company for less than the amount of the assessment. In the action brought by South Lake, it is understood the amount of the deficiency is $1.16 per share. There are forty-eight defendants in Houghton County, owners of large blocks of stock, it is stated, and the issue probably will come up for trial in the May term of the Houghton County Circuit Court.

Quincy's "New" Vein

The recent discovery of a rich vein of copper at depth in the Quincy mine, in the Michigan copper district, strengthens the theory that the copper in the Lake region came from below, inasmuch as values have just come into the vein, barren heretofore. The Quincy's find, known as the old Pewabic lode, became suddenly enriched at the 83d level of No. 6 shaft and the 86th level of No. 2. Enrichment continues as the openings are extended.

Carson Investment Co. Sues Nevada Consolidated

The Carson Investment Co., controlling the Carson patents for side-feeding reverberatory smelting furnaces, has filed suit against the Nevada Consolidated Copper Co., alleging infringement of the Carson patents. The suit was filed in the federal court at Carson City, Nev.

Tin as a Byproduct in British Columbia

The Consolidated Mining & Smelting Co. of Canada is recovering from one-half to two tons of tin, in the form of cassiterite, per day, as a table by-product from its Sullivan mine ore, and is setting it aside for future treatment. A number of small ingots of tin have been made from the mineral in the company's laboratory. The recovery is of much interest, as this is the first time tin has been recovered locally.

Lena Goldfields, Ltd.

The Lenskoie Mines, of the Lena Goldfields, Ltd., reports for the month ended Feb. 28, 1926: Mined, 42,581 cu.yd. of gravel and washed, 25,456 cu.yd.; from which 16,396.4 oz. of gold was obtained, having an approximate value of £68,865.

News From Washington

By PAUL WOOTON
Special Correspondent

Proponents of Copper Tariff Want 6c. Duty—Potash Bill Meets Opposition

DEVELOPMENTS in the Belgian Congo are encouraging the advocates of a duty on copper. Representative James, of Michigan, the author of the bill now before Congress which proposes a duty of 6c. a pound on copper and copper ores, admits there is no chance to open up the tariff at this session of Congress, but he recognizes the fact that a revision of the tariff law cannot be deferred indefinitely and says that the world situation in copper is operating to support the legislation which he has proposed.

With Katanga competition gaining momentum, the time is coming, advocates of the copper duty believe, when a considerable portion of the European market now supplied by the United States will have to be surrendered and a barrier erected to prevent the invasion of this market.

The only way the duty would become effective, say opponents of the plan, would be to reduce domestic production to the point where there would be no surplus for export. This would necessitate an understanding among all producers as to curtailment of production. Some suggest that the open-cut properties could be held "in stand-by" without the losses that would accompany the closing of shaft operations. To do this would require the assumption by the operating properties of reasonable returns on the capital invested in the stand-by properties and the payment of maintenance charges. Such a plan, it is held, is impractical, particularly as domestic consumption would be smaller, since manufactures of copper for export would be made from cheaper foreign copper so as to take advantage of the drawback. There also would be the question of dealing with the small producer who would be stimulated by the protective tariff.

Despite the objections, Mr. James feels that something must be done. He thinks it is indefensible for this country to continue to sell its copper at cost.

Some hope that the world price can be kept at a reasonably compensatory level through agreement such as might be negotiated among export organizations.

Director of Budget Opposes Potash Bill

As there is no indication that the Director of the Budget will adopt a more friendly attitude toward the potash bill, there apparently is little chance for the measure to become a law at this session. The measure, which has been approved by the Senate committee, proposes the authorization of an appropriation of $500,000 in an effort to develop additional domestic potash supplies. The plan is to spend a large part of the money for prospecting in the red beds of the Southwestern States.

There is objection to the measure, however, from more than the Director of the Budget. Some feel that the government should not go into the prospecting business. Moreover, they think there is no need for the government to undertake this work. The feeling is that private enterprise will do the prospecting if the favorable reports of the U. S. Geological Survey are emphasized sufficiently. Thousands of oil wells are drilled on less geological evidence, it is pointed out. In addition to the great opportunity for gain, oil and mining men will be induced to enter upon the quest by the fact that the discovery of potash deposits would be a great service to American agriculture and would free the nation of one of the raw-material monopolies.

The President was urged on April 1, by Senator Sheppard, of Texas, the author of the bill, and a delegation of those interested in the measure, to give it his approval. The delegation told the President that it would be a proper activity of the government to determine the quality and extent of the potash deposits of the Southwest.

In addition to Senator Sheppard, those in the delegation were: James F. Callbreath, Secretary of American Mining Congress; Dr. Henry Mace Payne, consulting mining engineer; Judge H. W. Seaman, of Clinton, Iowa; and L. J. Fose, general manager of the Mississippi State Board of Development. The committee also called on the Director of the Budget.

Oil Leases on Indian Reservations

So as to permit the development of the oil resources on the Indian reservations covered by executive withdrawal orders, the House of Representatives Committee on Indian Affairs has reported favorably a bill authorizing leases on such tracts.

The majority of the committee believes such legislation is best for the Indians and all concerned. The Indians get all the royalties and the states may levy taxes on the oil produced.

A minority of the committee believes the bill ratifies unauthorized leases by former Secretary Fall. They feel that it is legislating subject matter away from the Supreme Court, and contend that the mineral rights belong to the Federal Government and that the Indians have no equity in them.

Oil Possibilities in Southeastern Utah

The U. S. Department of the Interior has issued a brief summary (Memo. 6064) of the results of a reconnaissance study of southeastern Utah and southwestern Colorado that was made during the summer of 1925, by W. T. Lee and W. W. Boyer, of the U. S. Geological Survey, and also the results of an examination of the San Rafael Swell by James Gilluly, of the Survey. The summary states: The rocks exposed in southeastern Utah and southwestern Colorado that are of interest to the oil producer range in age from Pennsylvanian to early Upper Cretaceous. These rocks have been reviewed and described by Cross in Vol. 15 of the *Journal of Geology*, and a more recent description has been given by Coffin in Bulletin 16 of the Colorado Geological Survey.

Sulphur Exports from Sicily Decline in 1925

Sulphur exports from the island of Sicily amounted to 255,204 metric tons during 1925, compared with 303,463 tons in 1924, according to the U. S. Department of Commerce. Production during the same periods was 207,998 tons and 223,577 tons respectively. Stocks on hand on Dec. 31, 1925, were reported at 111,718 tons, a decline of 63,983 tons from those reported for Dec. 31, 1924. The decline in production is not attributed to exhaustion of the deposits but, rather, to the financial condition of the producers. Prevailing prices of sulphur are reported as being insufficient to yield a satisfactory margin of profit to the producers, who are faced with high production costs.

Portland Declares a Dividend

The Portland Gold Mining Co. has declared a dividend of 2c. a share, payable April 15 to stockholders of record on April 6. Though there is no assurance that the dividends will be "in order," as they were previous to five years ago, it is said that conditions are such as to warrant a belief that a wholesome revival is likely.

Government of Baden to Aid Local Potash Development

THE Diet of Baden recently voted 2,800,000 marks toward defraying the expenses of sinking potash shafts at Buggingen, a village in the Lorrach district between Mannheim and Constance, acording to a report to the U. S. Department of Commerce. A more recent state credit of 5,740,000 marks has also been authorized by the passage of a bill in both sessions of the Diet of the State of Baden.

A shaft was started at Buggingen in 1911, but discontinued at the outbreak of the World War. In 1922 work was again begun, and one shaft was recently completed, having reached potash salts at 2,600 ft. The quality is reported to be of the highest grade and similar to that obtained in Alsace. A second shaft is still being excavated.

The new mines, which are supposed to have touched the Alsace vein, are only 20 miles from the Rhine, which in the future may be an important asset on account of cheap transportation.

El Recuerdo Mine, Mexico, Shipping 15 to 20 Cars per Month

The main shaft is now 300 ft. deep, and development work on the 200 level of the El Recuerdo mine, near Vicente Guerrero, State of Durango, Mexico, has made some promising disclosures of ore. These indicate the continuity of the ore found on the 300 level and that near the surface. William B. Michel, president of the company, says that since Feb. 1, when the North American Lead Corporation took possession of the property, development work has opened up a large body of milling ore and that the mine is shipping at the rate of about 40 tons per day. The mine output will be increased to 200 tons per day as soon as the new hoist is installed.

All ore shipped so far has been carbonate and oxide, assaying as high as 13 per cent lead and 10 oz. of silver per ton. Approximately 60 per cent of all the ore hoisted is shipped direct to the smelter, the remainder being stored at the mouth of the shaft pending the construction of a mill. On the 300 level the mine workings are entering a sulphide zone which assays high in lead and silver. Development work is not sufficiently advanced to make possible definite statements as to tonnage, but indications are that a large orebody is near at hand. The mine is about 5 miles from the railway station, and ore is hauled from the mine under contract for $1.25 per ton. Labor costs vary from 37½ to 62½ cents, U. S. currency, per day.

Loading ore from El Recuerdo mine, Vicente Guerrero, Durango, Mexico, under contract price of $5 per car of 40 tons

Callahan Zinc-Lead Elects New Officers

The main office of the Callahan Zinc-Lead Co. will be moved from New York to Wallace, Idaho, on May 1. This announcement was contained in the annual report of John Borg, president of the company, which was made public on March 25. Mr. Borg also announced that his resignation of the presidency had been accepted, effective on May 1, and that Donald A. Callahan, of Wallace, Idaho, second vice-president, had been elected president to succeed him. H. T. McMeekin, of New York, secretary-treasurer, has also resigned, and C. W. Newton, of Wallace, general manager of the company, has been elected to take his place. Removal of the office to Wallace is a measure of economy.

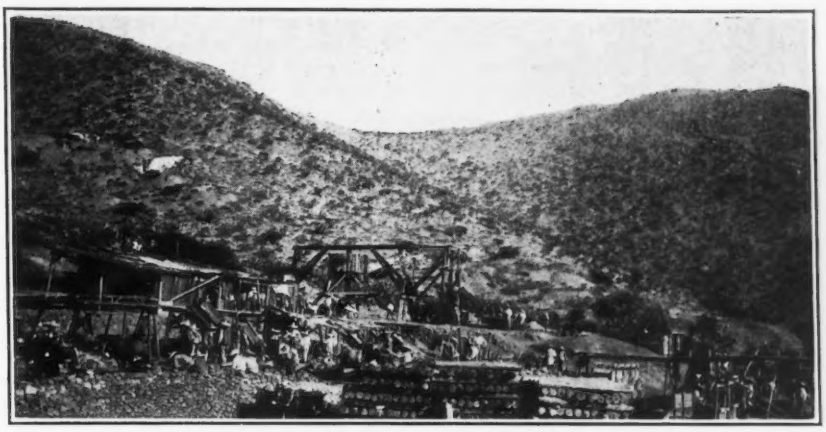
The annual meeting of the directors of the Callahan company will be held in Wallace on May 24, at which time, President-elect Callahan states, the question of future policy of the company will be discussed and decision reached relative to resumption of production, which applies to both the Galena property and the original Callahan mine. An extensive exploitation program has been carried out at the Galena, which has resulted in the development of sufficient tonnage to justify construction of a mill.

There is considerable tonnage left in the old Callahan mine, and it is indicated by the report of the president that arrangements will be made to mine this on a royalty basis.

Tamarack & Custer Find Extension of Monroe Vein

After prolonged discouragement in development results, the Tamarack & Custer Consolidated Mining Co., of Wallace, Idaho, has struck an orebody which promises to restore normal production at an early date, and conditions indicate that the shoot will be found continuous at much greater depth. This ore was struck in crosscutting on what is known as No. 7 tunnel level, about 700 ft. below the upper workings.

There are three veins in the Tamarack mine that have been productive in the upper workings. Two of these when crosscut and explored on No. 7 level were disappointing and raised doubt as to the future of the mine. The new oreshoot is in what is believed to be the Monroe vein, which has been very productive above and is said to have contained the richest ore in the mine.



Shaft of El Recuerdo mine, showing malacata, soon to be replaced by modern hoist

Jack Waite Construct Mill

The Jack Waite Mining Co., Union, Idaho, is constructing a mill of 100 tons' capacity in the Coeur d'Alene district. A two-mile tramway will connect it with a logging railroad, which will provide rail transportation for eight miles down Eagle Creek, terminating at a sawmill owned by the Mountain Lumber Co. From the mill to the railroad at Prichard is four and a half miles. The Jack Waite company has entered into an agreement with the lumber company through which this gap will be closed, thus completing rail transportation for the mine. The company has also entered into a contract with the Washington Water Power Co. for the construction of an electric transmission line three and a half miles long, to provide power for the mine and mill. The Jack Waite is now shipping.

Montana-Idaho Copper Leases Mine Near Winston

Montana-Idaho Copper Co., which for many years has been operating at Adair, Mont., has taken a bond and lease on the East Pacific property, near Winston, Broadwater County, Mont. The property is owned by State Senator Charles S. Muffly and associates, and when formerly operated there was developed one of the longest continuous oreshoots in the state. The mine is being unwatered with air-lift sinker pumps, under the direction of S. P. Burr.

Lake City Mines Sold

The Fanny Fern mine, near Lake City, Colo., has been purchased by Guy R. Harkness, of Lake City. Harkness was formerly with the Smuggler-Union mine, of Telluride. The price and terms are not made public. Whinnery and Hoffman, of Lake City, have acquired an interest in the Bullion King, 22 miles from Lake City. The ore assays high in copper.

Option Mining Co. Makes Final Payment on Mining Claims

The final payment of $21,500 has been made by the Option Mining Co., of Wallace, Idaho, under the terms of the bond held by the company on the Pacific and Ohio claims, which have been under development during the last year. The total purchase price was $35,000, and of the final payment $10,000 was made in cash and $11,500 by note for six months. The Option Mining Co., as its name implies, is the outgrowth of a development enterprise financed through the sale of ten-dollar options, a system devised by Stratton & Stratton, of Wallace, which was successfully adopted in the discovery of the Stratton mine. The company is operating on claims near Stratton.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Dome Handles 46,000 Tons of $7.70 Ore During March

At the present time Dome Mines, of Porcupine, is handling a record tonnage of somewhat lower-grade ore. March tonnage will be about 46,000 tons of $7.70 ore, which will provide a net revenue of a little less than dividend requirements. However, the dividend assurance fund is over $2,000,000, so there is no immediate danger of any cut. There are of course excellent chances for other discoveries in the mine, but a good deal of hope for future profits is based on Red Lake. If this property meets expectations, it should be able to carry the load, as it is one of the most remarkable showings, for the amount of work done, ever found in Canada. At present seventy teams of horses and three tractors are hauling in supplies in an effort to beat the break-up. These supplies and equipment include five diamond drills for the Dome and MacIntyre. These drills should be set up by the middle of April. There is considerable speculation as to how the Dome will finance the Red Lake property if it develops well, but this does not appear to be a matter which need cause concern. In addition to the dividend assurance fund there is a cash surplus of over $2,000,000, and half of this should be ample to make the necessary payments and finance operations to the point where the raising of further money would be a simple operation.

Cross trenches on the Howie-Red Lake property with which the vein was opened

Nipissing Has Reserves of 1,000,000 Oz.

The Nipissing company, of Cobalt, has found ore on the 200-ft. level of the South Lorrain property which it is operating. The drift on a more or less barren vein opened up two inches of ore which might be classed as high-grade. The annual report will be issued in a few days, and will, it is understood, show ore reserves of about 1,000,000 oz., and satisfactory results from the preliminary work on the properties which the company has under option in the Rouyn district of Quebec. A diamond drill is being shipped in to this property.

The Tonopah property in Gowganda has joined the list of silver shippers by sending out seven tons of high-grade, obtained as a result of development work. Work will start soon on the new 100-ton mill. The parent Tonopah company has taken an option at the Chance Syndicate properties in Quebec. The properties are close to the Alderson-Mackay claims, and $40,000 has been spent in surface exploration, which has resulted in the discovery of several ore bodies. The option calls for $200,000 for a 75 per cent interest with a $20,000 cash payment.

The shaft of the Argonaut property, in the Larder Lake district, has been deepened to 1,000 ft., at which level exploration work will soon be started, as well as at 875 ft. A new and larger hoist has been ordered. The mill is treating 100 tons a day, and returns are satisfactory. In the Kirkland section the option on the Pawnee Kirkland held by the Lucky Tiger company has been dropped.

Timmins an Outstanding Figure in Canadian Mining

As time goes on and the situation with regard to Quebec developments becomes clarified, one fact is becoming more and more apparent: that Noah Timmins, president of the Hollinger, is the outstanding factor. He has very large personal holdings in Noranda, and in addition the Hollinger, which he controls, gets a bonus of 30,000 shares for taking up the $3,000,000 bond issue. He personally controls the Waite-Montgomery, the next most important property outside the Noranda; he has large holdings in the Amulet, and he has a substantial interest in the Alderson-Mackay, with an option on further large blocks. During the last winter he has staked large acreages throughout the district, and has recently taken an option on the Helliwell claims near the Alderson-Mackay. He is easily the largest holder of good properties in Quebec, and if they develop according to expectations his income from them may even exceed his income from the Hollinger. We sometimes hear people bemoan the fact that Americans pick off our choicest mining prizes. This attitude indicates a narrow outlook, but if we had more men of Mr. Timmins' courage and foresight there would be much less ground for complaint.

Transportation to Central Manitoba Assured

It has been officially announced that the Manitoba Government will begin work immediately on the extension of the railway from Great Falls to Bull Dog Lake, Manitoba, a distance of 60 miles. The completion of this extension will provide easy access to the mining district of central Manitoba. A bill is now before the Provincial Legislature to provide for the establishment of an airplane service between Winnipeg and Red Lake.

Road communication from central Manitoba to within 40 miles of the Red Lake mining district is now assured, an agreement having been made between W. R. Clubb, Minister of Public Works for Manitoba, and T. A. Anderson, representing a mining syndicate. As part of the scheme a boat service from Riverton, Man., will be put into operation over a certain portion of the route. An extensive program of road improvements along the route is soon to be undertaken by the Provincial Government.

International Nickel Undertakes Extensive Development Program

According to an official announcement made by J. L. Agnew, president of the International Nickel Co., operating in the Sudbury district of Northern Ontario, a program of development involving a total expenditure of $8,000,000 will be undertaken during the coming season. The most important item on this program is the development of the Frood mine, near Sudbury. Shaft sinking and other work on this mine will begin the first of July next with a force of 250 men. When operations are in full swing from 1,800 to 2,500 men will be employed. Mr. Agnew stated that the International Nickel Co.'s holdings contained 100 million tons of proven ore. A considerable enlargement of the company's mining, smelting and refining facilities will also be made. When plans are carried out, the Frood will be the largest mine in Canada. Exploration work will be carried on between the 1,500 and 2,000 foot horizon, where there is ore in sufficient quantity to meet the demand of the proposed hoisting equipment for the next 25 or 30 years.

McIntyre Mills 1,400 Tons Per Day

The McIntyre mill at Schumacher, Ontario, is now treating 1,400 tons a day, and as the heads are about $9, this company should soon be the second gold producer of Canada. Profits are estimated at approximately 50 per cent of the production. The new ore recently found in the new No. 11 shaft at a depth of 2,225 ft. has been in the shaft for over 200 ft. and shows approximately $9 across a 10-ft. width. It is not yet known whether this is the No. 5 or No. 7 vein, but the presence of ore at this horizon was a surprise.

The shaft has reached a depth of 2,450 ft. and should reach the 3,000 level in about four months. Four levels from the 2,500 to the 2,875 are being developed from the No. 6 shaft.

French Mines Active

Mineral Production Approaching Pre-War Days—Potash, Phosphate, and Iron Most Important

By Francis Miltoun Mansfield
Special Correspondent

Paris, March 22—Along with her other serious preoccupations, France has prepared a balance sheet of her mineral resources as represented by her most important mining industries. The work has been confided to M. Georges Jouasset, delegate of the Union des Mines. Resources and possible profits therefrom form an important page in the history of French industrialism. Chief among these resources are the iron-ore deposits of the northern and eastern departments, the Pyrenees, Burgundy, the Gard, and those of Algeria and Morocco, collectively the most important of the mineral wealth accredited to any European country.

At the end of 1925 there were employed 32,000 mine workers of all ranks, as compared with 43,000 in 1913. Extraction reached 35,763,000 metric tons in 1925, compared with 28,992,000 tons in 1924, 13,921,000 tons in 1920, and 43,054,000 tons in 1913. This latter figure includes the output of iron ore in the Metz-Thionville region, then being worked by Germany. The product of the entire Lorraine basin, in 1925, represented 94 per cent of the national output.

It is difficult to appreciate the total French consumption of iron ore, as since Jan. 11, 1925, the important consuming territory of the Saar has been included within that of France, and exports thereto do not figure in the custom-house returns. The volume absorbed by metropolitan France is probably between 24 and 25 million metric tons.

Export of iron ore, not including that sent to the Saar, in 1925, was nearly ten million tons. This is a slight decrease from the figures of recent previous years, due to the lesser demand from England and Belgium. Nearly 80 per cent of the total export went to the furnaces of the Belgo-Luxembourg Union.

Germany, since the war, has imported less and less of Lorraine minette ore, which, in 1925, hardly formed a tenth of Germany's imports, whereas in 1913 it reached 27 per cent. The virtual boycottage, by Germany, has benefited Swedish mines, though it is believed that this state of affairs will soon change by reason of the large volume of coke required for the treatment of Swedish magnetic ore.

Alsatian Potash Deposits Contain 700 Million Cubic Meters

The rich deposits of Alsatian potash are thought to bulk 700 million cubic meters—one and one-half billion tons—with reduction to perhaps 300 million tons of pure potash. The mines have steadily increased their output since the French have come into possession. Potash, tartrates, and chlorides were exported to the United States in 1925 to the value of 44,000,000 francs, an increase of 28,000,000 francs over 1924 and 34,000,00 francs over 1923.

With 6,000 mine workers in 1925, the output was 1,665,000 metric tons, crude, giving 271,000 tons of pure potash. This was an advance from 350,000 tons and 56,000 tons respectively in 1913, at which time the mines were in German hands. The part French potash plays in world production is estimated at from 16 to 18 per cent.

Phosphates of Africa Equal Twenty-Five Billion Tons

The French production of phosphate in North Africa amounts to virtually five-sixths of the volume of European consumption and one-half that of the entire world. Moroccan deposits represent a reserve of 25 billion metric tons.

The 1913 world production of phosphate was 6,620,000 tons, one-half from the United States, but in 1924 it was 7,000,000 tons, of which virtually one-half was the production of the French protectorates of Tunisia and Morocco.

The area of the coal fields of France is approximately three and a half million acres. One-half is actually under exploitation in 648 active concessions, the total number of concessions granted by the government being 2,171. Reserves are supposed to run to 18 to 20 billion metric tons, a supply of three centuries or more for France at the present rate of consumption. It is stated that the national government participates in the profits of coal mining to the extent of 70 per cent. As a highly taxed industry coal mining in France appears to be unique.

Fables of various sorts have been current concerning the mineral riches of Morocco ever since the French occupation in 1912. It is even asserted that the German Mannesmann firm knew of vast gold deposits southeast of Agadir. From a report received recently in Paris it is evident that the mineralogical department of the French residency at Rabat by no means considers Morocco a new Eldorado, at least not publicly, though the rumor still persists of untold riches which will some day save the financial situation of France and Morocco. Prospecting has undoubtedly given encouraging returns, but except for phosphate in the French protectorate and iron in the Spanish zone little has as yet entered upon a commercial phase of exploitation. Numerous indications of petroleum have likewise been found.

With respect to phosphate and antimony, the material returns are by no means trivial. Various deposits are being discovered daily and exploited as circumstances permit, leading to the supposition that one day in the not too far distant future development will be on a grand scale. In four years the phosphate deposits of Bou-Jniba and Kourigha have revealed the importance of the resources, producing a phosphate with the high tenor of 76 per cent, and comparable with the phosphates of Florida. A plant for the treatment of phosphate rock has been installed for the production of agricultural fertilizer for use in the protectorate, and the raw material is shipped to all European and many overseas markets through a specially installed rail line from Zem to the port of Casablanca, where special docks have been constructed to handle the traffic.

The Société des Phosphates Tunisiens has a capital of 45,000,000 francs. Its financial situation is good. Its industrial facilities are believed to be sufficient for a long period, working its two deposits at Kalaa-Djerda and Meheri-Zebbeus, together furnishing 800,000 metric tons of phosphate, sufficient during the last year to yield a profit of well above 10,000,000 francs. Its product is shipped largely to two subsidiary companies in France for the production of agricultural fertilizers in the French Pyrenees.

One of the most remarkable mining stocks in activity on the Paris Bourse is that of "Djebel-Ressas," quoted on March 22 at 4,170 francs. The mines, situated in south Tunisia, sold, in 1924, lead and zinc to the value of 3,502,000 francs, and in 1925 the value of their production increased more than a million francs. The company has established a washing plant which permits the handling of all grades of zinc ore, thus utilizing low-grade ore which up to the present has been neglected. The Algerian mine of Guergour is likewise treating low-grade zinc ores by the same process, and in 1925 produced 14,511 tons of crude calamine and 8,141 tons of concentrates. Shipments through the port of Bougie exceeded seventeen thousand metric tons.

Anaconda Builds New Timber Mill

Fifty men are working at Rocker, Mont., building a new timber mill for the Anaconda Copper Mining Co., to replace the one recently destroyed by fire. The mill will have concrete foundations, a concrete cellar and a brick boiler house. Boilers will be used for heating, wood preserving, and power reserve. The main mill machinery will be run by electricity. The mill will be completed in four months, and will have a capacity of 60,000 pieces of framed timber per month. Through the courtesy of the W. A. Clark interests, Anaconda has been using the plant of the Western Lumber Co., at Bonner, since the fire.

Montana Power to Build 25,000-Hp. Plant at Black Eagle

According to announcement of Frank Kerr, vice-president of Montana Power Co., that corporation will install a new power plant at Black Eagle Falls, near Great Falls, Mont. The plant will generate 25,000 hp., to take care of additional needs of mining and industrial companies. During the construction period 300 men will be employed, and the total expenditure for the new plant will be close to $1,000,000.

London Letter

By W. A. Doman
Special Correspondent

South American Copper Syndicate Increases Capital—Falcon Mines, Rhodesia, Refinanced

London, March 23—Results of working the property of the South American Copper Syndicate, in Venezuela, have not come up to expectation, but matters are said to be now on a better basis. The Consolidated Gold Fields and the National Mining Corporation are interested, and it is proposed to raise additional capital by offering one new 2s. share at 4s. 6d. for every share held, thus doubling the nominal capital. There are £100,000 6 per cent notes to be redeemed and £50,000 extra is required. A commission of 6d. per share is being paid to the guarantors, or 25 per cent on the nominal value.

The Falcon Mines, in Southern Rhodesia, which produced gold and copper, shut down in August last, as the property became unprofitable to work. Instead of winding up it is proposed to reorganize the capital and raise additional funds to take up a copper property known as M'Tuga, in Northern Rhodesia, in the area belonging to the Rhodesian Congo Border Concessions. The capital of £400,000 in £1 shares is to be reduced to 5s. shares, and 1,200,000 new shares of 5s. each are to be created, and the unissued 200,000 £1 shares are to be divided into 5s. shares. In addition to receiving one new share at 5s. for each old £1 share, holders will have the opportunity to subscribe at par for one new share in respect of each share held. W. Wallace, the consulting engineer of the Gold Fields Rhodesian Development Co., has examined the M'Tuga mine, and reports that prospecting operations to a depth of 140 ft. have given good results. A length of 400 ft. has averaged 8 per cent copper over a width of from 10 to 40 ft., the ore actually proved for 160 ft. being estimated at 20,000 tons of 8 per cent copper. Tests of bulk samples have been made by mechanical concentration and by the oil flotation process of the Minerals Separation Co.

I mentioned recently that holders of Bwana M'Kubwa shares were getting disturbed at the fall in the price. No official statement has been made, but the trouble seems to be partly on account of a division among the board on the question of policy and partly on account of the delay in delivering the machinery, due to the recent washout on the Beira railway. The middle of the year is now said to be the approximate date for beginning production. Edmund Davie is in South Africa, and he is going to look into matters.

The Fabulosa Tin Mines property, in Bolivia, is now in the hands of the company's engineers, as an agreement has been come to with the minority shareholders who "jumped" the mine last year.

Though the price of tin is now £292 17s. 6d. per ton, it topped £300 last week, and as supplies are diminishing, a good future market is predicted.

Owing to a heavy rainfall, the Barrier mines, of New South Wales, are resuming full-scale operations. According to report, the Zinc Corporation has opened up a new lode going over 100 ft. in width, with good values, and the mine bids fair to rival the North Broken Hill.

Guatemala Petroleum Law Amended

Presidential Decree No. 912, according to the U. S. Department of Commerce, amends the reciprocity clause of the Guatemala petroleum law to permit petroleum exploration and development in that country by companies controlled by nationals of reciprocating countries, even though a minority of the shares in such companies is held by nationals of non-reciprocating countries.

Radio Utilizes 10,000,000 Lb. Copper Annually

The radio industry has more than doubled its consumption of copper during the last two years and is now approximating 10,000,000 lb. a year, according to the Copper and Brass Research Association.

From an average of 2½ lb. per set in 1924 and 4 lb. in 1925, copper consumption has been increased to 6 lb. per set through a long series of refinements and installations, the association report shows. Among these improvements are the greater number of tubes, refinements in circuit design, use of brass for panels and the adoption of shielding or lining for the interior of cabinets, so that installations are completely inclosed in metal.

Brass panels represent increased copper consumption of from ½ to 2 lb. per set, and the shieldings add from 1 to 4 lb. of copper per set.

Sierra Pinta Ships $20,000 Car of Ore

A shipment of 35 tons of concentrates by the Sierra Pinta Mining Co., operating at Quitovac, Sonora, to the A. S. & R. smelter at El Paso, Tex., is said to have netted the mining company $20,006. The mine is 15 miles from the Gulf of California, in Sonora, and is 83 miles south of Ajo, Ariz. About a carload of concentrate is shipped out every month, and in addition from $2,500 to $3,000 in gold bullion is sent to the mint at San Francisco.

Berta Mining Co. Resumes Shipments

The Berta Mining Co., which is conducting operations at Chihuahua, Mexico, is making weekly shipments of galena to the American Smelting & Refining Co.'s plant at Chihuahua. The company is installing a gas-oil burning, 104 hp. engine, compressors, and air drills preparatory to changing over from hand to power mining. Sixty-five cars shipped from the surface showed an average lead content of 40 per cent. R. E. Plumbe is president and general manager. E. K. Higgins is mining engineer for the company.

Johannesburg Letter

By John Watson
Special Correspondent

Premier Rustenburg Holds Annual Meeting—Platinum Areas 3,000 Square Miles

Johannesburg, March 2—The mineral production of the Union of South Africa, as published by the Mines Department, for January, is as follows:

	December	January
Gold	£3,317,779	£3,396,100
Silver	10,835	11,131
Osmiridium	8,660	17,247
Diamonds	712,619	742,005
Coal	317,689	283,124
Copper	42,963	40,667
Tin	25,624	15,888
Other minerals	20,579	18,547

The first output of platinum appears, the weight being about 155 oz. of crude platinum.

The first annual meeting of shareholders of the Premier Rustenburg Platinum, Ltd., was held on Feb. 19, Morris Green presiding. The properties from a block of about 33,700 acres. On the most northerly farm, Nitvalgrond, No. 334, nine pits have been sunk and the reef intersected in six of these. The exposures cover a distance of about 700 ft., showing high-grade ore in the footwall section. A combined average sample of the six pits gave 14.0 dwt. platinoids per ton over a width of 24 in. A sample of the footwall norite, below the reef proper, assayed 4.7 dwt. over 30 in. On the town lands, the total strike distance of the reef is about five miles. No full exposure has yet been obtained, but a sample over 12 in. of footwall assayed 13.9 dwt., another sample taken near this point assayed 24.5 dwt. over 18 in.

An independent mining engineer recently reported to important financial interests in London in regard to the future of the platinum industry in the Transvaal. The substance of this report was published in the latest number of *The Mining and Industrial Magazine.* The presence of platinum has been determined in about 3,000 square miles of the Transvaal, in quantities which are commercially attractive with platinum at about £24 per ounce. An agreement to limit the production of platinum is desirable, but would probably be difficult to enforce. This authority, therefore, believes that the price will fall, until only high-grade ventures will survive. Johannesburg, as a center, has much metallurgical talent, and at Germiston is the largest gold refinery in the world. He expects the Transvaal output of platinum for 1926 to be in the neighborhood of 18,000 oz. and next year (1927) it may be from 80,000 to 100,000 oz. Another correspondent has calculated that £5,000,000 will be expended upon machinery and equipment by platinum companies during the next three years.

On the Johannesburg Stock Exchange during the past week gold shares have been dull and easier. T. C. Lands were largely dealt in, but their price has receded from 68s. to 66s. 6d. during the week. Shares in the various Lydenburg platinum companies have been weak.

Societies, Addresses, and Reports

Internal Combustion Engines Topic at Oil and Gas Power Conference

A large group of technical societies is participating in an Oil and Gas Power National Conference with a nation-wide program of meetings during the week of April 19-24.

The purpose of the conference is to focus the attention of physicists, chemists, engineers, operating men, and industries on the recent progress and immediate possibilities in the utilization of oil and gas for power purposes. The program includes more than seventy-five gatherings at industrial centers where the scientific, production and economic problems related to internal combustion engines and their fuels will be discussed.

Many new developments will be presented for public discussion and criticism, one of which will be the application of the high-speed Diesel engine for automotive traction service. The extensive application of the Diesel engine to locomotive practice which is now in process, the design of oil engines for stationary power plants, and the increasing use of Diesel engines in marine work are some of the topics that will receive attention.

The public, as well as the entire engineering profession, are awaiting with great interest the reports on the series of tests being conducted by the Shipping Board on the huge Diesels ordered for Shipping Board service. The test results will be reported at some of the meetings during the conference.

One feature of the conference meetings is the large number of papers prepared in plain terms to reveal the rapid advances in the application and use of internal combustion engines for power purposes.

A prize of $100 will be conferred on the writer of the paper that best fulfills the objects of the conference. The award will be made by a committee of outstanding chemists and engineers.

Petroleum Geologists at Dallas

At the annual meeting of the American Association of Petroleum Geologists, held in Dallas, Tex., March 25 to 27, the following officers were elected. President, Alexander W. McCoy, of Denver; vice-president, Charles R. McCollom, of Los Angeles; secretary and treasurer, Fritz Aurin, of Ponca City, Okla.; editor of the *Bulletin*, organ of the association, John L. Rich, of Ottawa, Kan.

Pan-Pacific Science Congress

Under the auspices of the National Research Council of Japan, the third Pan-Pacific Congress is to be held from Oct. 27 to Nov. 9, 1926. The secretary of the Geological Society of America requests that members who plan to attend notify him as soon as convenient. His address is Charles P. Berkey, Columbia University, New York City.

Edward Dean Adams Receives John Fritz Gold Medal

Leader in Niagara Falls Hydro-electric Development Given Recognition—Notable Gathering at Ceremony.

Edward Dean Adams was presented with the John Fritz gold medal in the main auditorium of the Engineering Societies Building on Tuesday, March 30. The award was made for great achievements as "engineer, financier, scientist, whose vision, courage, and industry made possible the birth at Niagara Falls of hydro-electric power." Appropriate exercises were held in connection with the presentation, Dr. Frank B. Jewett, past-president of the American Institute of Electrical Engineers and the present chairman of the John Fritz medal board of award, presiding.

Before the presentation, there was a dinner of the board of award and guests at the Engineers' Club, at which addresses were made by Charles F. Scott, of Yale University; L. B. Stillwell, chairman of the Engineering Foundation, and Dr. W. H. Onken, Jr., editor of *Electrical World*.

Niagara Marks New Epoch

Mr. Scott brought out the fact that the history of the Niagara Falls Power Co. is the history of the pioneer of the hydro-electric system, a forerunner of the modern utility power service. It recorded, he said, the great step in the transition from mechanical to electrical power. He further stated, that this event of the nineteenth century was the great adventure of the world in power. The engine of Watt and the flow of falling rivers made mechanical power replace muscular power; the pulling of trains and the doing of miracles in industry by the vast multiplications of the power of the worker had thus created a new epoch in human history.

Mr. Stillwell made the point that there were in 1917, when we went into the war, only 20 million horsepower of power electrically generated, and that if the Niagara development had been delayed five years we would have had five million horsepower less when we needed it.

The presentation speech was made by Major Fred J. Miller, chairman of the committee which made the award. In his response Mr. Adams gave a brief history of the development of the power of Niagara Falls. Other speakers were James M. Beck and Prof. Arthur Edwin Kennelly, of Harvard.

James M. Beck, Solicitor-General of the United States, deprecated the failure of the government to provide any system of rewards for its citizens of outstanding merit. He advocated some system by which public recognition might be given to such men.

Professor Kennelly dwelt on the history of the Niagara Falls power development and declared that instead of disfiguring Niagara, the hydro development there had but diverted a part of its beauty, to transform it and deliver it to many thousands of persons in distant homes.

Metal Refining Feature of American Electrochemical Society Program

The American Electrochemical Society will hold its annual convention at the Chicago Beach Hotel, on April 22, 23, and 24. The Saturday morning session of the meeting will be devoted to papers on electrolytic refining and plating of metals. Per K. Frolich, of the Massachusetts Institute of Technology, has carried out an elaborate investigation on electrolytic lead deposits and on electrolytic zinc deposits. F. F. Colcord, vice-president of the U. S. S. Lead Refinery, Inc., will describe an electrolytic process for the treatment of doré bullion, which process is carried out in a new plant embodying many improvements in design. The plant is situated at East Chicago, Ind. H. S. Rawdon, physicist of the U. S. Bureau of Standards, will present results on the protective action of cadmium on iron and steel. In general the experiments indicate that cadmium stands in the same relation to iron that zinc does. H. E. Haring, associate chemist, Bureau of Standards, will outline a simple method for measuring polarization and resistivity. H. C. Parker and W. N. Greer, of the Research Department, Leeds & Northrup Co., have investigated the use of the quinhydrone electrode in nickel-plating baths. They have developed an exceedingly easy and accurate method for the control of the acidity of nickel-plating baths by making use of this electrode.

On Friday morning the retiring president of the society, F. M. Becket, vice-president of the Electrometallurgical Corporation, will deliver an address on "Modern Requirements in the Education of an Engineer." Following this address, the meeting will be devoted to miscellaneous electrochemical papers. Dr. T. Fujihara, a recent graduate of Harvard University, will discuss the corrosion of iron. H. C. Kremers, with A. P. Thompson and W. B. Holton, have prepared in comparatively large quantities of metallic yttrium, one of the very rare metals. The metal is highly crystalline, with a specific gravity of 4.57. When introduced into iron, an alloy results which is resistant to acids.

Michigan College of Mines Alumni Organize at Globe

Michigan College of Mines alumni in the Globe-Miami district, in Arizona, recently gave a banquet at the Old Dominion Hotel in Globe, for Dr. W. O. Hotchkiss, the new president of the institution. C. A. Kumke, E. Savicki and E. Elliott, of Ray; W. Sweeney and W. Gomez, of Miami; C. E. Weed, W. E. Cassup, W. H. Hopkin, V. Carus, A. Rood, C. Merritt, E. F. Rasmussen, E. Lawrence, and W. G. Scott, of Inspiration; and W. Deane, J. White and F. Hoar, of Globe, were present. Before the close of the evening a Michigan College of Mines Alumni organization for the district was formed. W. G. Scott and E. F. Rasmussen were elected president and secretary, respectively.

Men You Should Know About

John A. Burgess, consulting engineer and geologist of San Francisco, is at Leadville, Nev., on professional work.

George Otis Smith, Director of the U. S. Geological Survey, was recently in San Francisco on a brief business trip.

Dr. George C. Branner

Dr. George C. Branner, State Geologist of Arkansas, will soon make a geological survey of the coastal-plain area of Arkansas, which will cover about half the state. Several months will be spent on this work, in which Dr. Branner will have the assistance and co-operation of the U. S. Geological Survey.

S. K. Dahl, of Los Angeles, has returned to his offices after an extended business trip through Arizona and Mexico.

W. T. Mason has been elected president of the Grover-Daley Mines Ltd., operating in the Rouyn gold area of Quebec.

W. R. Brown has been appointed assistant general manager of the Anglo-Chilean Nitrate Corporation and is on his way to Chile.

W. H. Blackburn, who has charge of development work at the Tybo mine, 60 miles northeast from Tonopah, Nev., has returned to Tybo from San Francisco.

R. A. Kinzie, mining engineer of San Francisco, recently returned from a trip to Mexico City in the interest of mining companies which are under his direction.

Samuel A. Lewisohn, vice-president and treasurer of the Miami Copper Co., sailed on April 3 for a pleasure trip to Italy. He expects to be away about two months.

U. C. Tainton, consulting metallurgist of Kellogg, Idaho, has been in New York. He is negotiating for the introduction of his processes at the plants of several companies.

F. B. Weeks, geologist, has returned to San Francisco from an examination trip on the west coast of Mexico and is now on his way to Daggett, Calif., where he has mining interests.

Gordon R. Campbell, of Calumet, Mich., president of the Calumet & Arizona Mining Co. and the New Cornelia Copper Co., has left for Arizona to visit the properties of these companies.

Henry A. Wentworth, of Boston, has returned from a visit to the Central Manitoba Mines property, for the development of which during the coming season a comprehensive program has been prepared.

Leo Ranney announces that he has assumed the presidency of the Ranney Oil Mining Co., an engineering and geological organization devoted to the technical problems of the recovery of oil by mining operations.

A. L. Webb, engineer of the Canada Mines Syndicate, Ltd., operating in the Lochalsh-Goudreau district of northern Ontario, has returned from a visit abroad, and will superintend work at the Cline property of the company.

J. D. Northrop, of the Conservation Branch of the U. S. Geological Survey, left Washington on March 21 for a conference with **H. J. Lowe** at Muskogee, Okla., after which he attended the meeting of the American Association of Petroleum Geologists at Dallas, Tex.

Charles Hollister

Charles Hollister, of Tacoma, Wash., has been engaged for some time in examination work in Montana for the American Smelting & Refining Co.

E. E. Fitz-Henry, metallurgical engineer of Santiago, Chile, has recently completed and put into satisfactory operation the first lead-zinc selective flotation mill in Chile, at the San Pedro de Nolasco mines, belonging to Don Carlos Besa, president of the Sociedad de Minera, of Chile.

C. B. Kingston is soon to retire from the post of consulting engineer to the African and European Corporation (late Lewis and Marks), Ltd., Johannesburg. **I. L. van Eyssen** has now been appointed to the post and **W. A. Krige,** will take over the management of the Crown Diamond Mines.

F. R. Koeberlin, consulting geologist of Santiago, Chile, passed through New York recently en route to St. Louis, Mo. Mr. Koeberlin has spent ten years at Santiago, devoting his time largely to the investigation of South American tin deposits. An article by him on tin deposits will appear in the issue of *Engineering and Mining Journal-Press* of April 17.

George Campbell Carson, old-time prospector, "sour dough," and, according to his claims, which have been upheld by the U. S. Supreme Court, originator

Photo from Wide World

George Campbell Carson

of the idea of side-feeding reverberatory furnaces, has recently won still another decision, the Circuit Court of Appeals of California refusing to reopen the case. Though claiming something like $20,000,000, Carson says that "Court decisions are one thing and cash is another."

A. D. Hughes, consulting engineer of the Ludlum Engineering Corporation, of New York, started on March 31 for Central America. He will make a preliminary examination of several promising placer properties in Honduras and Guatemala. Later he will go to Colombia, where he will examine and report on a dredging property on the Nare River. Upon his return to New York Mr. Hughes has arranged to inspect some newly discovered placer ground in the Porcupine district of Ontario now controlled by Boston capitalists.

Obituary

Gerald Coleman Fitzpatrick, of Johannesburg, died at Southampton, England, on Feb. 20. For the last twenty-four years he had been a member of the Johannesburg Stock Exchange. He was born in Kingwilliamstown in 1865, being a son of the late Justice and a brother of Sir Percy Fitzpatrick. He was a director of the Newmann group of mines and during the war was an active worker for the Governor-General's Fund.

Richard H. Stretch, mining and civil engineer, naturalist and author, died in Seattle, Wash., on March 22. Mr. Stretch went to the Pacific Coast in 1867, and in 1870 was city engineer of San Francisco. He removed to Seattle in 1888, and had lived there most of the time until his death. Mr. Stretch many years ago wrote a very useful little volume on prospecting and mine valuations, and also reports on some of the

famous mines of the West. He was of English stock, and leaves a son, A. J. Stretch, of Los Angeles, and a sister.

Francis E. House, president of the Duluth & Iron Range Railway, died on April 3. Mr. House was born at Houseville, N. Y., seventy years ago, a son of Henry A. and Mary E. House. After studying for three years at the Rensselaer Polytechnic Institute he started as a mining engineer and assayer with the Manhattan Silver Mining Co., in Austin, Nev., in 1877. Three years later he entered the engineering department of the Chicago, Milwaukee & St. Paul Railway. In 1894, he became chief engineer for the Pittsburgh & Lake Erie. He held the same position with the Pittsburgh, Bessemer & Lake Erie in 1896 before joining, as general manager, the Duluth & Iron Range Railroad, of which he has been president for the last twenty-five years.

James MacFarlane, for sixteen years chief engineer for the Anaconda Copper Mining Co., died on March 30 last, in the seventy-first year of his age. He supervised the building of the Milwaukee railroad through the copper country of Montana, and left the Anaconda in 1901 to take charge of the Cerro de Pasco mines, in Peru, for James B. Haggin and associates. On his return from Peru he opened an office in New York, coming to Denver about twelve years ago. Mr. MacFarlane was a native of Perth, Scotland, and was educated at the University of Edinburgh. He was a member of the Denver Motor Club, the Lakewood Country Club, and the Rocky Mountain Club. He had planned to make a visit to Scotland this summer. His widow, two sisters, and four brothers survive.

Lloyd Skinner, mining engineer and graduate of the University of Nevada, died in San Francisco on March 29, 1926. He was born Aug. 16, 1882, and completed his university work in mining in 1906. Inyo County, Calif., was his principal field of activity. His father, incidentally one of the Pike's Peakers, of Colorado, was also one of the early pioneers of Inyo County and was responsible for the introduction of irrigation in Owen's Valley. After leaving the University, Mr. Skinner was employed at Cerro Gorda from 1908 to 1911 and was superintendent of the property. He and his brother, William Skinner, of Lone Pine, took a lease on the mine when company operation was discontinued. Both were early leasers in the Original Bullfrog and also operated the Christmas Gift mine, at Darwin, for a number of years, making a gross production of $500,000 from this small mine. About eleven years ago Lloyd Skinner met with a serious accident in an automobile wreck, and he remained an invalid since that time. Undaunted by his condition, he kept at mining work and was successful in building up an excellent reputation. Severely handicapped as he was, he maintained a cheerful front on life and did what he could to earn his way and to advance the position of mining in his immediate locality. Mine maps were brought to him and his advice was sought in planning exploration. Surveyors and engineers profited from his general knowledge of conditions of the region, and many went to Lone Pine to consult with him. His home in Lone Pine, where he lived with his mother and his brother's family, became a center of interest, proving that even though a man may be unable to go forth into the world, the world will come to his bedside if he has something to give, and Lloyd Skinner ever remained the cheerful giver and a helpful mining man. He had a wide circle of friends in Nevada and California who derived inspiration from the competent way in which he bore his misfortune.

Charles Gregory Yale

Charles Gregory Yale died in San Francisco on March 25, 1926, at the age of seventy-eight. Yale was long identified with the mining industry of the Pacific Coast and played a constructive part in the development of that industry. He was born in Florida, and very early in life his father, Gregory Yale, one of the early mining lawyers of San Francisco, took him to California, making the voyage around the Horn and arriving in San Francisco in 1850. Since that date, Charlie Yale, as he was affectionately called by his many friends and associates, lived in California and advanced the interests of mining and grew into the industry. He started out to be a mining engineer and entered the University of California to study mining and assaying. The death of his father threw him into active life when very young. At the age of twenty-three he joined the editorial staff of the *Mining and Scientific Press*, where he remained twenty-three years, serving as writer and finally as editor on that pioneer mining publication. When he left the *Mining and Scientific Press* he entered the employ of the government as statistician and played an important part in the collection and publication of the statistics in mineral resources for many years, retiring only a few years ago. Until his death he was librarian of the Bohemian Club of San Francisco. Charles G. Yale years ago did some mining and opened the Golden Chariot mine, in San Diego County, and was also interested in mining in the Mother Lode region, chiefly in Tuolumne County. His tastes and abilities followed a literary bent, and he concentrated on editorial work, dropping all connection with active mining. One of the important services which he rendered California was in the rehabilitation of hydraulic mining. To use his own words: "I was one of those who drew up the appeal to the people of California to assist the hydraulic miners, and I happened to be the only mining representative from the city of San Francisco to the convention. I was by that body appointed a committee of one to try to organize the movement in San Francisco and to get the daily papers in line to help the miners again. On my return to the city I was fortunate in getting the active assistance of my young friend William C. Ralston, and between us we managed to arrange a meeting of a few prominent mining people, and we organized the San Francisco Miners' Association, of which I have been the perpetual secretary. We also got the daily papers to accept articles which I wrote on the subject of the condition of the hydraulic mining industry. The result of these efforts was the organization of the California Miners Association. At the first convention of that body, I, as editor of the *Mining and Scientific Press*, was appointed to represent the miners, and Robert Devlin to represent the anti-débris men, and we together drew up the memorial to Congress adopted by the convention, which resulted in the passing of the Caminetti law, permitting hydraulic mining to go on under certain conditions. The law has not had the good effect hoped for, but it certainly permits hydraulic mining where it was not permitted before." One of the functions of a mining paper is to make clear to mining men the intricacies of science, of law, and many puzzling things. This Charlie Yale did in a very direct way by answering all questions submitted to the paper. As he said in his reminiscences: "Among other departments which used to be in vogue with us was that of 'Answers to Correspondents.' This was a big nuisance to me sometimes, as conundrums were propounded which it took a good deal of looking up and running around to answer. As I had succeeded Mr. Hodges as editor of the paper, so I had succeeded him as secretary of the California Academy of Sciences, a position which I held some sixteen years. On scientific topics, therefore, I had good advisers. On mining topics, geology, mineralogy, and those connected with machinery there were plenty of able men I could consult with. It turned out, however, that a large number of the questions related to mining laws. A new mining law was passed by Congress, May 10, 1872, and we have it yet. Before that everything was done under the crude law of July, 1866. My father, Gregory Yale, had written the first treatise on mining law published in the United States, 'Legal Titles to Mining Claims and Water Rights in California.' To that work I had contributed some Spanish translations and a glossary of mining terms, the first of that sort published, I think. When the law of 1872 came into effect the miners were puzzled by its terms, and it became one of my editorial duties to answer questions on the subject. I had to make mining law a study, and consult books and lawyers, so that I became quite expert on that subject, and was considered rather an authority, though a layman. I did not have any Judge Curtis H. Lindley to help the paper out on mining law questions in those days, so I had to make a study of it myself." The "Mineral Statistics of Western States," which appeared year after year under Mr. Yale's name, are in themselves a history of mining in those states. He was painstaking and accurate and did much to establish the standards which "Mineral Resources" has maintained. Charles G. Yale was a broad viewed, genial and capable man of high standards. Two daughters, Mrs. Enid Gracey and Mrs. Etta Arnold, of Shanghai, China, and their families survive him.

Recent Technical Publications

Reviews, Abstracts, and References

Transactions of the American Institute of Chemical Engineers. Vol. 16, Part 2. Published by D. Van Nostrand Co., New York City. Price $5.

The following papers, contained in this book, will be of interest to some mining engineers: "Notes on the Development of the du Pont Cyanide Process," by H. G. Chickering, 12 pages; "Super Sublimed White Lead," by J. H. Calback, 16 pages; "Electrolytic Calcium Arsenate," by Stewart J. Lloyd and A. M. Kennedy; "Synthetic Gypsum, Its Recovery and Use," by Robert S. Edwards, 16 pages; "Refractories," by M. C. Booze, 8 pages; "The Control of Furnace Atmosphere," by W. Trinks, 16 pages; and "Improvement in Thickening and Water Clarification," by Noel Cunningham, 10 pages.

Colorado Mining—An exceedingly interesting history of mining in Colorado has just been issued by the U. S. Geological Survey as Professional Paper No. 138, by Charles W. Henderson (263 pages). It is entitled "Mining in Colorado—a History of Discovery, Development, and Production." The old-timers who have worked in Colorado at one time or other will find much that will recall past experiences and associations. The state reached its peak of production in 1900, when $50,000,000 worth of gold, silver, copper, lead, and zinc were produced, though mining was active throughout the period from about 1890 to 1917. In 1900 the San Juan region was turning out its maximum production of gold, and Leadville had made a come-back, though its production was not comparable with what that district had done in the early 80's. Pitkin County was also a heavy producer in that and succeeding years. This book is not only of interest to Colorado people, but also contains much concerning the development of milling and smelting methods that will interest one, even though he has never been a resident of the state. A large topographical map, in colors, and several sketch maps are included. Obtainable for $1 per copy from the Superintendent of Documents, Washington, D. C.

Mineral Resources — Recently published separates of "Mineral Resources of the United States, 1924," include: "Lead and Zinc Pigments and Salts," 8 pages, by C. E. Siebenthal and A. Stoll; and "Mica," by Blanche H. Stoddard, 11 pages. The last-named paper discusses imperfections in mica, production, classification, uses, mining methods, preparation for market, and imports and exports. Copies of either bulletin are obtainable from the Superintendent of Documents, Washington, D. C., for 5c. each.

Rock Drilling—"Drilling Holes in Rock" is the subject of an illustrated 30-page paper in the *Journal* of the South Africa Institution of Engineers for February. (Johannesburg; price 2s.) The author, Henry S. Potter, discusses drill steel at length in the first part of the paper and then takes up the various types of hammer drills in use in South Africa.

Cam & Motor Gold — The *Mining Magazine* for February contains a 13-page article on recent mining and metallurgical developments at the properties of the Cam & Motor Gold Mines, in Southern Rhodesia, by Digby V. Burnett. (London, price 1s.) The mining system adopted includes a stope drive made along the reef, from which crosscuts are extended to the footwall at intervals of 30 ft. From the information thus obtained, the direction of the main reef drive is determined. This drive is carried just under the footwall of the lode and 10 ft. below the stope drive. Short rises, or box-holes, are put up from the main drive to the crosscuts above and form the ore passes. Early treatment of the ore was difficult, as it consists of stibnite, arsenopyrite, and pyrite, intimately mixed with quartz, aluminum silicates, and calcium and magnesium carbonates. Direct treatment of slime-roasted ore by cyanidation and filtration was a failure, and the ore contained a quantity of coarse free gold that was not readily dissolved by cyanide. A process of concentration, roasting, amalgamation, and cyaniding has been an improvement.

Iron Ore Prices—*Iron Trade Review* for Feb. 18, 1926, has a brief article by A. J. Hain entitled "What of Iron Ore Prices in 1926?" being a study of ore and commodity prices in the last twenty-five years, and of present conditions in the industry. (Cleveland, Ohio; price, 25c.)

Research—Circular of the U. S. Bureau of Standards No. 296 (20 pages, obtainable on request from the Bureau at Washington, D. C.) is entitled "Research Associates at the Bureau of Standards" and tells of the co-operative research plans that are being carried out. Any industrial organization that wishes to detail men to work out certain of its problems is given free use of the Bureau's facilities, under conditions that are outlined in this pamphlet.

Arizona Mining—The Fourteenth Annual Report of the Mine Inspector of the State of Arizona was recently issued, and may be obtained on request from the State Mine Inspector, Phoenix, Ariz. It contains a list of all mining companies in the state, the number of men employed, and what stage of development the properties are in. A complete list of all mine accidents during the year is also given. (pp. 81.)

Recovery of Scrap Copper—Adolph Bregman has an article on this subject in the March issue of *The Metal Industry* (99 John St., New York; price 10c.). Sources, sampling, and methods of recovering and refining are briefly discussed.

Mining in California — The October issue of *Mining in California*, obtainable free from the California State Mining Bureau, Ferry Building, San Francisco, describes all the mines and prospects of importance in Siskiyou, San Luis Obispo, and Santa Barbara counties.

Patents

Fume Precipitation — No. 1,574,237. Feb. 23, 1926. Hans Edler, Gelsenkirchen, Germany. Apparatus for the electrical purification of gases, consisting of bars of angular cross-section serving as collecting electrodes, and sparking electrodes consisting of flat bands with their narrow edges facing the collecting electrodes.

No. 1,575,165. March 2, 1926. Ernest Hopkinson, New York City. Method and apparatus for electrical precipitation of particles in gaseous suspensions.

Flotation — No. 1,574,403. Feb. 23. 1926. S. E. Meyer, Hayden, Ariz. A flotation cell of the porous mat type.

Reissue No. 16,279. March 2, 1926. Risdale Ellis, Oak Park, Ill.. assignor to Ellis Flotation Co., Inc., New York City. A flotation process, using oil and acid, the contact potential of the oil being made more negative by the addition of another reagent.

Rotary Furnace — No. 1,574,932. March 2, 1926. A. H. Pehrson, Stockholm, Sweden. A rotary furnace having three coaxial chambers of varying cross-section, the central section being the main chamber, in which gas may be admitted.

Dehydrating Minerals—No. 1,574,950. March 2, 1926. W. R. Wade, Edwards, N. Y., assignor of one-half to New York Zinc Co., Inc., Edwards, N. Y. A method of dehydrating mineral substances by feeding them into a furnace flue communicating with a combustion chamber and containing hot gases of combustion. A blast of air is supplied to carry the material through and out of the flue.

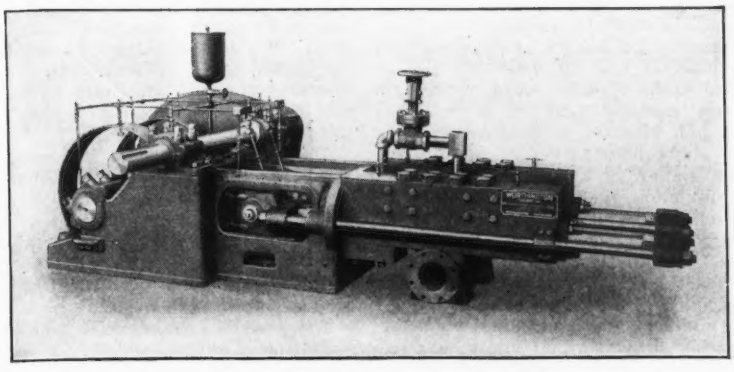
Sulphur Production — No. 1,574,987. March 2, 1926. Carl Marx, Wyoming, N. J., assignor to Union Sulphur Co. Sulphur is recovered from sulphide ores by distilling them under a high vacuum and condensing the vapors. Patent No. 1,574,988 covers the same process of recovering sulphur from ores containing it in elemental form.

Copper-Nickel Separation—No. 1,575,160. March 2, 1926. Sigurd Giertsen, Kristiansands, Norway, assignor to Kristiansands Nikkelraffineringsverk, Kristiansands, S. Norway. Copper is separated from copper-nickel solutions by treating them with Bessemer copper-nickel matte containing less than about 10 per cent of sulphur.

No. 1,577,422. March 16, 1926. N. V. Hybinette, Ottawa, Ont., assignor to Anglo-Canadian Mining and Refining Co., Ltd. Copper is cemented on copper-nickel matte from a copper-nickel sulphate solution. The remaining matte and cement copper is roasted and leached with sulphuric acid to form a copper sulphate solution. The residue is reduced and dissolved to form a copper-nickel solution from which copper is cemented upon a further portion of bessemerized matte.

Magnetic Separator — No. 1,576,690. March 16, 1926. Georg Ullrich, Magdeburg, Germany, assignor to the Firm Fried. Krupp Grusonwerk Aktiengesellschaft, Magdeburg-Buckau, Germany. A process of passing material through successive magnetic fields, to effect separation of magnetic particles.

New Machinery and Inventions



Small forged-cylinder pump. This one is 4½ by 12 in.

Forged-Cylinder Pump Now Made in Smaller Sizes

A forged-cylinder pump for feed and auxiliary oil pipe lines has been developed by the Worthington Pump & Machinery Corporation, New York. In extending its line of forged-cylinder pumps into the smaller capacities and pressures, the company asserts, a self-contained, substantial, and rigid unit of exceedingly compact design has been made possible.

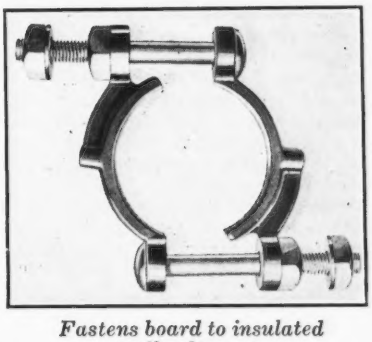
These forged end pumps are built in capacities up to 40,000 bbl. per twenty-four hours. The one illustrated is a 4½ by 12-in. duplex double-acting pump and has a capacity of 6,000 bbl. per twenty-four hours. It is designed for a maximum pressure of 900 lb. per square inch, or a normal working pressure of 750 lb. per square inch. Its over-all length is 12 ft. 10.5 in. and its over-all width 6 ft. 2 in.

Each cylinder and its passages are tooled out of solid machine-steel forging. The throats are bronze-lined, with deep stuffing boxes; the flow is straight and all clearance close. Plungers are of high quality steel. Valve chambers are tooled out of the cylinder forging. Steel ball valves of the encaged type operating on hard gear-bronze renewable seats are used. Each valve is separately accessible from above through individual valve chamber covers. All parts of the power end of the pump are readily accessible. The crankshaft and connecting rods are steel forgings.

Trolley Guard-Board Support

A simple clamp that makes it possible to install guard boards after a trolley line is in place in a mine is a recent development of the Ohio Brass Co., of Mansfield, Ohio. Often when haulageways are extended it becomes desirable to add guard boards to the trolley line. This simple device, consisting of two clamping pieces and bolts, can be fastened around the skirt of any insulated trolley hanger having a diameter ranging from 3¼ to 3¾ in. After the two clamping pieces are rigidly attached to the hanger, it is a simple matter to slip suitably drilled guard boards over the extended clamping bolts. A nut and washer on the outside of each guard board holds it in place.

This fitting is said not to affect the installed trolley hanger or clamp and can be readily removed and reinstalled in another location when desired.



Fastens board to insulated trolley hangers

This clamp may be slipped around the skirt of hanger. The clamping bolts are then passed through holes in the guard boards. Both trolley and guards are thus suspended from the same hangers.

Automatic Re-centering Motor Bearings Developed

Many of the troubles experienced with electric motors are the result of bearing wear permitting the rotor to rub on the stator. To insure a continuous uniform air gap in motors, the Howell Electric Motors Co., of Howell, Mich., has brought out a complete line of motors with anti-friction bearings, in which any looseness in the bearing, caused by wear or otherwise, is instantly and automatically taken up, so as to keep the rotor of the motor continually centered. This is done by using a Timken tapered-roller bearing shimmed with a fluted wire spring which acts as a compression spring.

The inner race or cone of the roller bearing is fitted on the shaft with a light press fit. The outer race or cup is fitted into the housing of the motor end bell with a sucking fit which allows creeping of the outer race. The spring is held tight against this outer cup by the outer grease cap, pushing the cup tightly against the rollers and keeping the bearings tight at all times. This type of bearing is put in each end of the motor.

Separate Company to Handle New Thickener

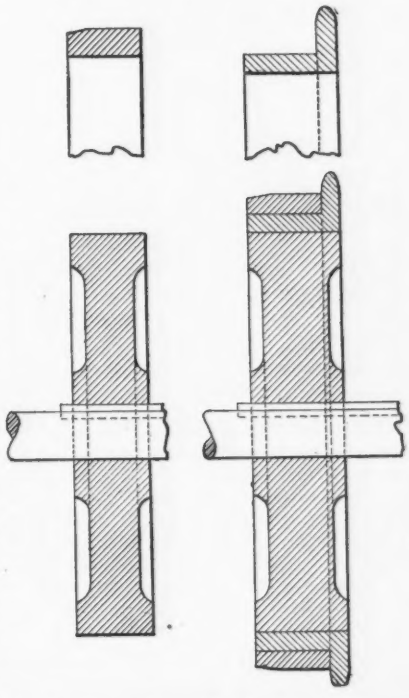
The General Engineering Co., of Salt Lake City, Utah, and New York City, and A. L. Genter have transferred their interests in the Genter thickener to the Genter Thickener Co., Inc. The offices of this company will be at 159 Pierpont St., Salt Lake City, and 50 Broad St., New York. The business will be under the management of Mr. Genter and the offices of the General Engineering Co.

Two-Piece Locomotive Tire

In the accompanying illustration may be seen a new type of locomotive tire recently patented by J. N. Abbott, of Christopher, Ky. In this construction the tire is made in two parts, the inner one carrying the flange and the outer acting as the tread proper.

When the tread wears, as all treads do, it can be replaced without incurring the expense incident to a complete tire renewal. To change locomotive tires it is generally necessary to withdraw the drivers and their connecting axle, remove the gear and send the balance to the machine shop, where the tires are ground or turned down. This consumes much time and keeps the locomotive out of use for at least one shift.

With the construction here shown it is claimed that a change can be made much more quickly. It is merely necessary to raise one end of the locomotive and cut off the worn tread either with a hammer and chisel or with the acetylene torch. The new tread, having been previously heated, may then be slipped into place, and allowed to shrink. It is claimed that replacement of a worn tread may be accomplished in a few minutes' time and that one flange will outlast several treads.



Cross-sections of wheel and tire

Trap with multi valves operated by thermostatic bellows

A New Heavy-Duty Blast Trap

A type of steam trap having seven valves operated by thermostatic bellows is a recent development of the Trane Co., La Crosse, Wis. The thermostatic element is the same as used in the radiator trap, which has been manufactured for some years by this company. In the new trap the bellows are not connected in any way and each functions independently to close its respective outlet when steam reaches it.

The bellows are arranged to operate under balanced pressures—that is, the pressure on the inside of the bellows and the pressure surrounding are the same at all times. This tends to increase the life of the bellows and allows it to be used in higher pressures than would be possible with an unbalanced pressure.

The traps are designed for pressure up to 125 lb. and are made in 1¼, 1½ and 2 in. sizes, giving capacities ranging from 1,000 to 15,000 lb. of water per hour, depending upon the size and pressure.

Angle iron clamp with strong holding jaws

Clamp Holds Angle Iron Trolley

The use of the bulldog trolley clamp principle has been extended by a recent development of the Ohio Brass Co. to include an application where angle iron is employed as the trolley contact. The adaptation consists in the substitution of clamping jaws shaped to grip a standard 2½x2½-in. angle, in place of the customary wire clamping jaws. With this device the bulldog line is said to include suitable clamps to handle practically any form of trolley contact and feeder suspension.

Crawler Loader Has Large Capacity

A new crawler loader, known as the "Grizzly," has been placed on the market by the Link-Belt Co. of Chicago. This machine contains many improvements in design and detail of construction, and is said to handle crushed stone, gravel, sand, phosphate and like materials at the rate of 1¾ cu.yd. per minute, or about 140 tons per average hour.

This loader is a one-man machine. Its propulsion, operation, and care can be handled entirely by one worker of average intelligence. Four units make up this machine, namely, the elevator, the chassis, the power plant, and the crawler. The unit system of construction is employed, enabling the operator to inspect the machine easily, and to make any adjustment or repair without tearing it apart.

Special attention has been given to the lubrication of moving parts, all of which are provided with Alemite fittings or grease cups placed within reach of the operator. All bearings and moving parts are large enough to keep wear to a minimum, thus assuring long life to the complete unit.

It is claimed by the builder that any one can learn to operate this machine with but a few minutes' instructions. It can travel forward and reverse; and turn right or left when traveling in either direction. The starting, turning, and stopping are all controlled by two hand levers, which automatically apply brakes when stopping. The elevator is controlled by separate hand lever, which operates a steel clutch. This disengages automatically when machine is started in reverse.

The buckets used in the elevator are of special design, with reinforced edges to reduce wear. They are spaced closely enough, on double strands of malleable iron and steel chain, to insure a steady delivery of material to the delivery chute, the principle involved being that close spacing of buckets permits a lower speed of the elevator, with consequent less wear.

Head and foot sprockets are made of manganese steel, cast in two parts, and clamped on hexagonal steel shafts. This eliminates troublesome keys. The hexagonal shafts are journaled, and are run in babbitted bearings, oil-grooved, and provided with Alemite fittings. The driving wheel on the elevator head shaft is provided with a safety breaking pin. The chute at the head of the elevator, as ordinarily furnished, is of the swiveling type. It operates through an angle of 180 deg. and can be controlled from the operator's platform.

The feeder consists of manganese steel paddles, securely bolted to the hexagonal foot shaft, and so arranged as to produce a steady feed of material to the buckets. Feeder adjustment and collapsing mechanism are both controlled by a hand wheel within reach of the operator.

The chassis is made of heavy angles, plate and channels, securely riveted together, making a substantial support for elevator and machinery. A large steel casting is riveted to the structure forming the connection to the front crawler shaft. The rear of the frame is supported on a large steel bracket casting, pinned to the rear axle.

The power plant is a simple, compact, gasoline unit of 30 hp. at 1,200 r.p.m., equipped with a governor; an electric motor may be substituted if desired. The truck transmission has three speeds, giving 33 ft. or 66 ft. per minute in the forward direction, and 29 ft. in the reverse.

All driving and control machinery for crawler and elevator is housed in. All shafts are of turned and all gears of cut steel. Bearings are bronze-bushed. The housing is dust-tight, and partly filled with oil, which assures sufficient lubrication to all parts.

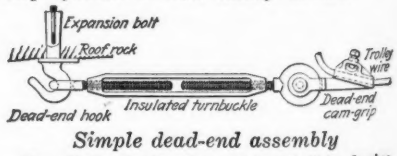
All drives are made by means of roller chains, running on steel sprockets. All are protected by sheet steel guards. The crawler is of channel and plate construction, riveted together, making a rigid housing for sprockets and idlers. The sprockets are of the self-cleaning type, made of steel, bronze-bushed. The treads are made of special heat-treated steel, cast in one piece, 11 in. wide, 11⅞ in. pitch, and run on cast steel idlers, also bronze-bushed, with large chambers for lubrication. A special design of shoes and sprockets guarantees self-cleaning. The rollers are of large diameter, and keep the bearings up out of the dirt.

Dead-End Assembly Saves Trolley Wire

To fill the need for a simple yet substantial and complete device for terminating trolley lines, the Ohio Brass Co., of Mansfield, Ohio, has placed on the market parts for a new dead-end assembly.

This device consists of a heavy malleable-iron hook which can be affixed to the standard overhead hanger or expansion bolt, an insulated turnbuckle and a wire-clamping device which utilizes the recently announced cam-type grip. This latter is of particular value in the assembly as it eliminates all the waste of wire usually entailed where dead ends are formed by bending or looping trolley wire around some rigid support.

This new dead-end assembly is equally useful for permanent and temporary installations. It can be removed with ease and used over and over as the line is extended. A material saving in time and labor is said to result from the employment of this handy device.



Simple dead-end assembly

Simplicity is the key note of this device. It consists of a hook fitted with an expansion bolt that may be anchored in the roof, an insulated turnbuckle and a trolley-wire grip.

The Market Report

Metal Prices Easier, With Quiet Demand

Copper Substantially Unchanged but Lead and Zinc Down Today—Easter Holidays Affect Market

New York, April 7, 1926—Total sales of non-ferrous metals in the week ending today have been smaller than usual, partly owing to the fact that the London market was closed from Friday to Monday inclusive. Copper has been in fair demand all week, with practically all producers quoting 14c. delivered in the East. Lead activity has continued, but further declines in London have forced a recession in price here. Only small orders for zinc have been placed, and with few buyers the price dropped down to 7c. today. Silver has changed but little, continuing at comparatively low prices, slightly above 65c. London silver is lower than at any time since 1916.

Daily Prices of Metals

April	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N.Y.	St. L.	St. L.
1	13.775	62.875	64.00	8.20	8.00	7.20
2	13.80	63.00	64.00	8.225	8.025	7.20
3	13.80	63.00	64.00	8.225	8 025	7.20
5	13.725	63.00	64.00	8.20	8.025	7.175@7.20
6	13.75	62.75	63.75	8.20	8.00	7.15@7.175
7	13.70	62.50	63.50	8.00	7.875	7.00
Av.	13.758	62.854	63.875	8.175	7.992	7.158

The prices correspond to the following quotations for copper delivered: April 1, 14.025c.; 2nd and 3rd, 14.05c.; 5th, 13.975c.; 6th, 14.00c.; 7th, 13.95c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
1	57 7/8	58 3/4	64 3/4	287 3/4	279 1/4	30 11/16	30 7/8	33 9/16	33 11/16
2	Holiday	....	...	....	....	....	....	....	....
5	"	....	...	....	....	....	....	....	....
6	57 7/8	58 3/4	64 3/4	286 3/4	277 3/4	30 5/16	30 11/16	33 1/2	33 3/4
7	57 1/2	58 3/8	64 3/4	285	274 3/4	29 13/16	30 3/8	33 1/4	33 3/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

April	Sterling Exchange "Checks"	Silver		Gold London	April	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
1	4.85 3/4	65 1/2	30	84s 10d	5	4.85 3/4	65 3/8	Holiday	.....
2	4.85 3/4	65 1/4	Holiday	.....	6	4.85 3/4	65 1/8	29 7/8	84s11 1/2d
3	4 85 3/4	65 1/4	"	.....	7	4.85 3/4	65 1/8	29 15/16	84s11 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Copper at 14c. Delivered

A little copper was still to be had last Thursday morning at 13¾c. delivered in the East, but business was good on that day, and most of the orders were placed at 14c., with a good tonnage also sold in the Middle West at 14⅛c. Practically no business was done on Friday and Saturday, but sales in the last three days have again been of fair proportions, and largely at unchanged prices, though some sellers have been willing to shade prices a little. Most of the demand is for April-May. Users of copper are as optimistic about future business as ever and apparently have not experienced any decline in their orders comparable at all with the weakness in the stock market.

Foreign business has been exceedingly quiet, a quietness accentuated by the Easter holidays. American agencies have quoted 14.20c., c.i.f. Dealers may have been willing to sell a little cheaper, but no one has done much business.

A. S. & R. Marks Lead Down to 8c.

Following further recessions in London and a quiet week in the domestic lead market, the American Smelting & Refining Co. this afternoon reduced its official contract price for New York delivery to 8c. per pound. The only hopeful feature in the European situation seems to be that the decline in spot metal is greater than that in futures, thereby widening the contango. Despite the fact that the leading interest seems to have lead available for immediate shipment, premium prices up to 8.35c. have been obtained by other sellers in the East, on spot metal. Likewise, in the St. Louis district business has been done at 8.05c. where immediate delivery has been specified. Most of the transactions have been for April delivery, though one large order in New York specified May shipment. One important seller reports noticeable slackening in buying by storage-battery makers, but this is offset in large measure by active buying on the part of lead-covered cable manufacturers. The cut by the Smelting company will prevent for the time being the entry of foreign bullion lead in the domestic market.

Zinc Declines To 7c.

The zinc market has been unusually quiet all week. On Thursday and Friday, 7.20c. was paid for prompt Prime Western, but since then lack of demand here and slightly declining prices in London have weakened the market, so that not more than 7c. could be obtained today, with few buyers showing any interest at all. High-grade is unchanged at 8¼c., with

current production well absorbed in consumptive channels. New York zinc is at the customary premium of 35c. per 100 lb. above St. Louis.

Tin Still Dull

Tin buying by consumers has been decidedly limited. In sympathy with declines in London, attributed largely to speculative trading, the domestic price has fallen off, spot Straits closing today at 63½c. The June position rules at about 2c. under the spot price, but the latter is entirely nominal. April can be done at 63¼c.

Silver Still Sags

During the last week China has continued to sell abroad, and foreign dealers' buying rates for San Francisco delivery have been successively lower, with the result that the market has shown a further decline. New York fell to 65¼c. on April 6, which level has not been touched since May 15, 1924, and we have to go back to July 20, 1916, to find a quotation of 29⅞d., which was the London spot price also on April 6.

Mexican Dollars; April 1st, 2d, and 3d, 50c.; 5th, 50⅛c.; 6th and 7th, 49⅞c.

Exchanges Quiet

The principal foreign exchanges have been featureless during the last week. Closing cable quotations on Tuesday, April 6, were as follows: francs, 3.48c.; lire, 4.02⅜c.; and marks, 23.81c. Canadian dollars, 3/32 per cent discount.

Zinc Blende and Lead Ore Prices Unchanged

Joplin, Mo., April 3, 1926

Zinc Blende	Per Ton
High	$53.80
Premium blende, basis 60 per cent zinc	$48.00@$49.00
Prime Western, basis 60 per per cent zinc	47.00
Fines and slimes, 60 per cent zinc	$46.00@$44.00
Average settling price, all lead	$47.17
Galena	
High	$109.75
Basis 80 per cent lead	100.00
Average settling price, all lead	104.76

Shipments for the week: Blende, 13,010; lead, 1,656 tons. Value, all ores the week, $787,190—the smallest week of the year.

Purchases this week only 12,020 of a production of 18,730 tons, creating an increase of 6,000 tons stock in the bins. The total is 27,040 tons.

A policy of restriction is being observed by only a few of the heavier producers in a limited manner. Companies observing this policy report their output lowered 20 per cent.

The lead market is extremely quiet, with very light demand. Producers who are unwilling to accept the present price level have accumulated approximately 13,000 tons in their bins.

Platteville, Wis., April 3, 1926.

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$50
Lead Ore	
Lead, basis 80 per cent lead	$104

Shipments for the week: Blende, 800 tons; lead, none. Shipments for the year: Blende, 13,120; lead, 362 tons. Shipments for the week to separating plants, 1,479 tons blende.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118 per long ton.

Antimony—Per pound, duty paid, New York: Chinese brands, spot, 19@18c. May arrival, 18¼@17¼c. Cookson's "C" grade, spot, 22c. Market quiet and spot prices mostly nominal, though some speculative buying is reported.

Bismuth—$2.70@$2.75 per lb., in ton lots. London, 10s.

Cadmium—60c. per lb. Market slow. London, 1s. 9d. for Australian metal.

Iridium — $225@$235 per oz. for 98@99 per cent. Nominal. London, £70@£75 for 99.5 per cent.

Nickel—Ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent); London, £170@£175 per long ton.

Osmium—$85@$90 per ounce; London, £19@£22.

Platinum — $112 per ounce refined officially quoted. Sales also at $106@$109. Crude, $105@$106. London, £22½@£23½ for refined; crude, £21@£22.

Quicksilver—Per 75-lb. flask: $88.50 for spot and forward. San Francisco, $89.33. London, £14⅝.

Ruthenium — $75@$85 per ounce; London, £13@£16.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Palladium, Radium, Rhodium, Selenium, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of April 3.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $11.75@$12; Western scheelite, $12.25@$12.75. Domestic demand very light, and prices largely nominal.

Vanadium Ore—Containing 4 to 8 per cent V_2O_5, 25@30c. per pound of V_2O_5 f.o.b. Montrose, Colo.

Chrome Ore, Manganese Ore, Molybdenum, Tantalum, and Iron Ores are unchanged from quotations in the April 3 issue.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the April 3 issue.

Fluorspar—Several hundred tons of German fluorspar, 85 and 5 per cent grade, have been sold in the last few days at $17 to $18 per net ton, duty paid tidewater.

Mineral Products

Arsenious Oxide (White arsenic)—3½c. per lb. Small sales. London, £14@£15 per long ton.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the April 3 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $88@$90 per gross ton. Domestic market now in hands of three interests: Bethlehem Steel Co., E. J. Lavino & Co., and Electro Metallurgical Sales Corporation, which are said to have cut prices below cost of production and to have eliminated British competition.

English spiegeleisen is again entering the market, reported to have sold for $34.25, New Orleans, for 19 to 21 per cent grade.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from prices in the April 3 issue.

Metal Products

Rolled Copper — Sheets, 22½c.; wire, base price, 16½c. per lb.

Lead Sheets—Full, 11¾c. per lb.; cut, 12c.

Nickel Silver—29½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 19¾c. per lb.; rods 16¾c.

Zinc Sheets — 11.75c. per lb., f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite are unchanged from prices in the April 3 issue.

Steel Steady—Pig Iron Lower—Coke Dull

Pittsburgh, April 6, 1926

Steel production in the last five months has been about 5 per cent above the rate in the best five-month period of the past, March being the best month of the five, and there is now no diminution visible in the rate of mill operation.

Steel prices continue steady, with scarcely any variation. Plates in the general Pittsburgh area have firmed up to 1.90c., having for several weeks been quotable at 1.85c. to 1.90c. Sheets are fully as unsteady as a fortnight ago, and mill operations are a trifle lower.

Pig Iron.—On a willingness of the Standard Sanitary Manufacturing Co. to buy foundry iron, after the market had been stagnant for a long time, $19, Valley, or $1.50 decline, was quoted, and 5,000 tons were bought, with other purchases to follow. After practically five months of no change, the Valley market is now $20 for bessemer, $19 for foundry, and $19 for basic.

Connellsville Coke.—The market is very dull, with prices unchanged, at $3@$3.25 for spot furnace and $4.50@$5 for spot foundry.

Company Reports

U. S. Steel Net Increased $5,229,810

Increased earnings in the last half of the year 1925 offset lower ones in the first half and made a better showing for the U. S. Steel Corporation than in 1924.

Comparative Income Account

	1925	1924
Earnings—Before charging interest on bonds and mortgages of subsidiary companies:		
First quarter	$41,849,764.09	$52,129,738.62
Second quarter	42,634,705.17	43,407,005.15
Third quarter	44,523,558.12	32,715,060.16
Fourth quarter	44,775,397.22	32,931,664.06
Total for year	$173,783,424.60	$161,183,467.99
Less interest on outstanding bonds and mortgages of the subsidiary companies	8,244,959.93	8,068,656.07
Balance of earnings	$165,538,464.67	$153,114,811.92
Less charges and allowances for depletion and depreciation applied as follows, viz.:		
To depreciation and replacement reserves and sinking funds on bonds of subsidiary companies	45,463,053.99	38,687,668.14
To sinking funds on U. S. Steel Corporation bonds	10,623,625.44	10,205,168.92
Net income in the year	$109,451,785.24	$104,221,974.86
Deduct		
Interest on U. S. Steel Corporation bonds outstanding	17,761,388.75	18,274,207.49
Premium paid on bonds redeemed by sinking fund, viz.:		
On subsidiary companies' bonds	222,329.77	182,350.09
On U. S. Steel Corporation bonds	880,439.61	785,295.44
Balance	$90,587,627.11	$84,980,121.84
Add net balance of sundry receipts and charges, including adjustments of various accounts	15,025.78	87,069.77
	$90,602,652.89	$85,067,191.61
Dividends on U. S. Steel Corporation stocks, viz.:		
Preferred, 7 per cent	25,219,677.00	25,219,677.00
Common, regular 5 per cent, extra 2 per cent	35,581,175.00	35,581,175.00
Surplus net income	$29,801,800.89	$24,266,339.61
Less sums appropriated and expended or to be expended account of additions, improvements or betterments to plants and property	25,000,000.00	20,000,000.00
Balance carried forward to undivided surplus	$4,801,800.89	$4,266,339.61

Production

The production of the several principal departments for the year 1925, in comparison with results for the preceding year, was as follows:

	1925 Tons	1924 Tons	Increase Tons	Increase Per Cent
Iron and manganese ore	27,996,845	24,774,541	3,222,304	13.0
Limestone, dolomite and fluorspar	5,344,893	5,033,889	311,004	6.2
Coal	31,475,568	27,738,007	3,737,561	13.5
Coke	16,301,224	14,408,041	1,893,183	13.1
Pig iron, ferro and spiegel	14,798,999	12,683,729	2,115,270	16.7
Steel ingots (bessemer and open hearth)	18,898,697	16,478,857	2,419,840	14.7
Rolled and finished steel products for sale	13,271,010 Bbl.	11,722,908 Bbl.	1,548,102 Bbl.	13.2
Universal portland cement	15,722,000	15,156,000	566,000	3.7

National Lead Co. Increases Surplus

The report of the National Lead Co. for 1925 says that sales of white lead in oil were 18.1 per cent less than in 1924, and 20.9 per cent less than the average for the last four years. Company officials are disposed to attribute this decline to the high price of pig lead and the increased consumption of cheaper competitive pigments. The manufacturing capacity in the United States for both white lead and the oxides of lead has increased beyond the requirements for consumption, with the result that competitive conditions are becoming more and more severe and the margin of profit correspondingly reduced.

The resulting decrease in profits has been more than made up by the exceptionally large profits in the company's mines. Attention of stockholders is called to the agreeable fact that the variety of manufactures and new investments of the company permit a fairly uniform and satisfactory showing of profits, notwithstanding the diversity of detail entering into such profits.

Consolidated Balance Sheet on Dec. 31, 1925

Assets		
Plant investment	$59,657,058.12	
Less depreciation and depletion reserves	19,388,317.65	
		$40,268,740.47
Other investments		12,272,112.78
Current assets		43,390,700.43
Total assets		$95,931,553.68
Liabilities		
Capital stock:		
Preferred	$24,367,600.00	
Common	20,655,400.00	
	$45,023,000.00	
Bonds of subsidiary companies	6,916,000.00	
Insurance reserve	3,492,592.24	
Empolyers' liability reserve	315,459.71	
Plant reserve	2,500,000.00	
Promotion reserve	1,500,000.00	
Metal reserve	1,000,000.00	
Tax reserve	3,663,199.06	
Accounts payable, audited but not due	4,450,959.62	
Notes payable		
Surplus, Dec. 31, 1925	27,070,343.05	
Total liabilities		$95,931,553.68

Statement of Net Earnings

Surplus, Dec. 31, 1924		$25,795,154.47
Net earnings for 1925, after deducting all expenses, reserves		4,633,352.58
		$30,428,507.05
Less dividends		
Dividends on preferred stock at 7 per cent	$1,705,732.00	
Dividends on common stock at 8 per cent	1,652,432.00	
		3,358,164.00
Surplus, Dec. 31, 1925		$27,070,343.05

Good Year for Benguet Consolidated

The Benguet Consolidated Mining Co., producing gold in the Philippine Islands, treated 92,700 tons of ore of an average value of 34.05 pesos during the year ended Dec. 31, 1925. The gross value of gold and silver produced was 2,927,469.04 pesos.

Profit-and-Loss Statement for 1925

	Pesos	Pesos
Receipts		
Bullion	2,956,820.24	
Exchange	5,432.54	
Interest	18,776.65	
Store operation	30,335.99	
Rentals	4,223.65	
Sale of securities	1,644.16	3,017,233.23
Expenditures		
Labor	468,599.64	
Supplies	415,172.61	
Taxes	99,066.57	
School and hospital	19,895.43	
Insurance	5,040.94	
Marketing bullion	21,960.49	
Mine miscellaneous	15,384.09	
Manila office	59,337.86	1,104,457.63
Gross profit		1,912,775.60
Less depreciation	192,201.16	
Less development written off	89,971.85	
Less miscellaneous	32,108.96	
		314,281.97
		1,598,493.63
Less bonus to general manager		39,962.34
Net profit		1,558,531.29

Ore Reserves

Estimates as of Dec. 31, 1925, were as follows:

	Tons	Pesos
Positive ore—exposed on four sides	53,897	1,840,747.16
Probable ore—exposed on at least one side	29,470	802,460.00
	83,367	2,643,207.16

Dividends

The following dividends have been paid for 1925:

March 31	10 centavos per share—quarterly dividend
March 31	5 centavos per share—extra dividend
June 30	10 centavos per share—quarterly dividend
August 31	10 centavos per share—extra dividend
September 30	10 centavos per share—quarterly dividend
December 19	10 centavos per share—quarterly dividend

Calumet & Hecla Operating Profit $4,016,844

The Calumet & Hecla Consolidated Copper Co., operating in Michigan, during the year 1925 produced from its mines 64,250,000 pounds of copper at an average cost sold, but not including depreciation or depletion, of 11.26c. per pound. During the same period, and not included in the above, there was produced from the reclamation plants at Lake Linden and Hubbell 26,957,000 pounds of copper at an average cost sold of 7.06c. per pound. The average price received for copper delivered during the year was 14.23c. per pound.

The Calumet & Hecla reclamation plant made a new high record of copper production on sand of lower than average grade. There were no new developments of importance except the use of improved flotation reagents, which accounts for the lower tailing.

The results for the year and to date follow:

	Year 1925	Since Starting
Tons treated	2,125,000	11,768,218
Assay headings, per cent	0.600	0.687
Assay tailings, per cent	0.120	0.179
Pounds refined copper	20,278,000	121,007,924
Pounds refined copper per ton treated	9.54	10.28

Of this copper 4,066,000 pounds was from table treatment following grinding, 13,148,000 pounds was from leaching, and 3,064,000 pounds was from flotation.

Earnings Statement, Year 1925

Receipts		
Copper sales	$14,027,580.49	
Custom smelting	89,466.89	
Dividends	67,813.10	
Interest	207,918.38	
Miscellaneous	58,051.02	$14,450,829.88
Disbursements		
Copper on hand Jan. 1, 1925 (a)	$4,243,036.27	
Production, selling, administration and taxes	9,291,390.70	
Miscellaneous	81,937.79	
	$13,616,364.76	
Less copper on hand Dec. 31, 1925 (a)	3,182,379.25	10,433,985.51
Operating profit		$4,016,844.37
Depreciation	$1,769,762.49	
Depletion	2,683,757.98	4,453,520.47
Deficit carried to surplus		$436,676.10

(a) Not including depreciation or depletion.

Balance Sheet, Dec. 31, 1925

Assets			
Current assets			
Cash		$2,616,384.27	
Liberty loan bonds at par		850,000.00	
Notes receivable		472,245.06	
Accounts receivable		3,799,038.67	
Copper on hand, including depreciation and depletion		4,694,745.11	
Deferred charges		86,297.26	
Supplies at mine		2,316,312.15	
			$14,835,022.52
Investment in other companies			1,816,671.88
Capital assets			
Real estate, stumpage and timber		$4,744,283.85	
Mine lands	$52,742,942.07		
Plant	30,099,703.92		
	$82,842,645.99		
Less reserves for depreciation and depletion	20,673,591.02		
		62,169,054.97	
Stamp mill patents		30,558.75	66,943,897.57
Total assets			$83,595,591.97
Liabilities			
Current liabilities			
Accounts payable			$1,468,392.23
Capital stock			
Issued, 2,005,502 shares, par value $25 per share			50,137,550.00
Surplus			
Paid-in surplus Jan. 1, 1925		$35,434,578.84	
Deficit for year	$436,676.10		
Dividends paid	3,008,253.00	3,444,929.10	31,989,649.74
Total liabilities, capital and surplus			$83,595,591.97

Best Year for Tintic Standard

In the year 1925 the Tintic Standard Mining Co. exceeded all previous records in the gross value of its output and the profits obtained. The company mines lead-silver ore in the Tintic district in Utah. The milling plant at Harold, Utah, was closed, and the low-grade siliceous ore is now being shipped to the Garfield smelter under a favorable smelting contract. The property of the Iron Blossom Mining Co., in the Tintic district, was purchased for $375,000 and paid for during the year. The balance sheet as of Dec. 31, 1925, shows current assets of $4,023,756.50 against current liabilities of $844,446.

Statement of Operations for the Year Ended Dec. 31, 1925

Gross sales	$7,116,629.37	
Less smelter deductions	1,981,765.97	
Income from ore sales		$5,134,863.40
Deduct:		
Mining and milling operating expenses		1,550,323.79
Profit from mining and milling operations		$3,584,539.61
General and administrative expenses		84,801.29
Net operating income before providing for depreciation		$3,499,738.32
Annual provision for depreciation:		
Mine plant and equipment	$55,583.46	
Mill plant and equipment	94,787.29	150,370.75
Net profit from operations		$3,349,367.57
Add		
Non-operating income		
Interest earned	$167,063.34	
Rentals and other miscellaneous income	81,811.08	
Total non-operating income		248,874.42
Net income (before deducting taxes)		$3,598,241.99
Taxes		
State and county taxes	$235,406.45	
Federal income taxes	334,207.18	
Capital stock and license taxes	5,641.60	
Total taxes		$575,255.23
Net income—carried to surplus		$3,022,986.76

Production 1925

	Dry Tons	Gold, Oz.	Silver, Oz.	Lead, Lb.	Copper, Lb.
Lead ore	81,142.28	3,607.230	2,598,180.08	42,104,095.41	415,281.12
Dry silver ore	3,802.65	540,588	237,523.74	91,294.87	116,381.25
Mill ore	54,377.56	1,658.905	1,018,341.32	4,834,268.30	400,699.50
Low grade ore	13,232.56	688.924	228,833.75	1,043,159.46	100,792.76
Totals	152,555.05	6,495.647	4,080,878.89	48,072,818.04	1,033,154.63

Average Assay	Gold, Oz.	Silver, Oz.	Lead, Per Cent	Copper, Per Cent
Lead ore	0.044	31.99	25.94	0.256
Dry silver ore	0.142	62.46	1.20	1.530
Mill ore	0.030	18.73	4.44	0.368
Low grade ore	0.052	17.29	3.94	0.381

Lower Earnings by Ohio Copper

The copper production of the Ohio Copper Co. for the year 1925 was 6,271,556 lb., and the operating profit $355,664.04, compared with 11,115,329 lb. production and operating profits of $784,759.56 in the previous year. The lower production increased the cost per pound of copper produced to 8.3216c. per lb.; as against 5.815c. per lb. in 1924. Net profits after deducting fixed charges, taxes, and adjustment, but before depreciation and depletion, amounted to $237,318.57.

The company's financial condition continued to improve during the year, irrespective of the deficit of $27,365.81, shown in the report, which was occasioned by the usual large reserves set aside for depreciation of the old concentrating mill and new plant and for the depletion of the mine and the year's proportion of bond discount, all of which amounted to $223,297.32. An analysis of the statements after allowing for payment of a dividend of 5 per cent upon the capital stock, shows an increase in assets of $44,592.43, and a reduction in liabilities of $48,949.39, the result being a net gain for the year of $93,541.82.

Operating Profits and Quarterly Production

1925	Net Pounds	Cost, Cents per Pound	Price, Cents per Pound	Profit, Cents per Pound	Operating Profits
First quarter	1,632,772	7.9450	14.3400	6.3990	$104,416.92
Second quarter	1,509,438	8.4290	13.2740	4.8500	73,230.97
Third quarter	1,771,578	7.8040	14.2034	6.3994	113,374.48
Fourth quarter	1,357,768	9.3378	14.0986	4.7608	64,641.67
Year	6,271,556	8.3216	13.9926	5.6710	$355,664.04

Operating profits as above			$355,664.04
Miscellaneous income			27,434.27
			$383,098.31
Deductions			
Interest on bonds		$36,276.14	
Taxes, insurance, miscellaneous charges		109,503.60	145,779.74
Net profits 1925			$237,318.75
Reserved for depreciation new plant		$36,000.00	
Reserved for depletion of mine		77,828.32	
Years proportion of bond discount		7,802.52	121,630.84
Balance transferred to surplus			$115,687.73

New Cornelia Produced 69,262,286 Lb. of Copper in 1925

Operations of the New Cornelia Copper Co. for the year ending Dec. 31, 1925, resulted in production as follows:

Fine copper, lb.	69,262,286
Silver, oz.	209,860.60
Gold, oz.	14,355.92

Sales of copper during the year amounted to 68,286,072 lb., for which an average price of 14.182c. per pound was received.

Sulphide ore mined and delivered to crushing plants for flotation for the year amounted to 2,287,121 dry tons averaging 1.391 per cent total copper, containing 1.198 per cent sulphide and 0.193 per cent oxide copper. Carbonate ore mined and delivered to the crushing plants for leaching operations for the year amounted to 1,059,649 dry tons, averaging 1.157 per cent total copper. The soluble copper in the ore averaged 1.059 per cent, and insoluble copper, 0.098 per cent.

The estimated reserve tonnage of carbonate and sulphide ore is as follows:

Sulphide Ores

	Tons	Copper, Per Cent
Total sulpnides 0.8 to 3 per cent.	52,219,427	1.31
Total sulphides over 3 per cent.	2,363,896	3.65
Grand total, sulphides over 0.8 per cent.	54,583,323	1.41

Carbonate ores

	Tons	Copper, Per Cent
Total carbonates above 0.8 of 1 per cent.	3,277,028	1.25

Profit-and-Loss Account for 1925

Income		
Total earnings on metals	$10,235,225.32	
Dividends	21,857.48	
Other income	26,559.96	
		$10,283,642.76
Expenditures		
Operating expenses	$4,316,581.96	
Salaries, office and general expenses	85,785.37	
Freight, refining and marketing	1,257,089.65	
State and federal taxes	755,383.86	
Interest	143,653.91	
		6,558,494.75
		$3,725,148.01
Less		
Depreciation	$995,639.85	
Ore depletion	1,590,262.09	
Non-operative expenses	13,092.15	2,598,994.09
Net income		$1,126,153.92

The balance sheet for Dec. 31, 1925, shows current and working assets of $5,424,544, against current liabilities of $2,321,340.

Premier Development "Upon the Whole Disappointing"

The annual report of H. A. Guess, managing director of the Premier Gold Mining Co., producing silver and gold in British Columbia, says that a rearrangement of the milling equipment was made during 1925 and work was started upon the enlargement of the milling plant by the construction of another unit, making in all a daily capacity of 400 tons. This second unit will, it is expected, be completed and in operation some time in March, and the treatment, as now arranged, which will be similar also in the new unit, gives a more concentrated product, with correspondingly lessened tonnage of concentrates and a substantial saving in monthly freight and smelting charges as compared with previous practice.

Explorations and developments during the year, directed toward the discovery and opening up of new ore in five areas, have, upon the whole, been disappointing.

The estimated ore reserves as at Dec. 31, 1925, are as follows: Ore broken in stopes, 243,511 tons, averaging 0.64 oz. of gold and 14.7 oz. of silver. With gold at $20 per ounce and silver at 60c. per ounce, this represents a gross value of $21.62 per ton. Assured and probable unbroken ore down to the fourth level of the present mine workings, 316,484 tons, averaging 0.52 oz. of gold and 13.6 oz. of silver. With gold at $20 per ounce and silver at 60c. per ounce, this represents a gross value of $18.56 per ton. A summary of mining operations for 1925, also, for comparison, those of 1924, is as follows:

	1924	1925
Diamond drilling, ft.	15,838	13,500
Development drifts and raises, ft.	7,333	5,680
Total diamond drilling to date, ft.	51,582	65,089
Total underground workings, ft.	27,266	32,955
Ore mined, dry tons	159,014	168,555
Ore milled, dry tons	61,965	55,702
Ore shipped to Tacoma, dry tons	75,917	89,211
Ore shipped to Granby, dry tons	21,132	23,636
Table concentrates shipped, dry tons	6,302	1,329
Flotation concentrates shipped, dry tons	2,222	5,021
Precipitates shipped to Selby, tons	13.55	7.94
Ounces gold produced	139,288	119,720
Ounces silver produced	3,015,382	2,559,197
Pounds lead produced	452,010	870,974
Broken ore reserve, Dec. 31, tons	147,880	243,518
Ore broken during year, tons	213,894	264,182
Average price silver, per ounce, cents	66.78	69.08

Summary of Income and Profit-and-Loss Account, Year 1925

Value of ore sold: liquidations received	$2,752,898.00	
liquidations not received	514,316.34	
		$3,267,214.34
Operating and miscellaneous expenses		1,286,025.87
Earnings from mine operations		1,981,188.47
Miscellaneous profits—net		32,293.13
Total earnings		$2,013,481.60
Deduct		
Administrative expenses	$6,799.03	
Taxes (income taxes estimated)	405,848.48	
Depreciation	162,688.65	
Depletion	919,318.91	1,494,655.07
Balance of profits available for dividends		$518,826.53

Hedley Finds Little New Ore

According to the report of Gomer P. Jones, superintendent, of operations in British Columbia of the Hedley Gold Mining Co., Ltd., for the year of 1925 were carried on mainly with a view of diamond drilling the unexplored section of the property and financing this work from ore mined and milled from the old workings. This was accomplished, together with paying off the delinquent taxes for 1918, and in addition $34,188.74 was carried to surplus. Development and diamond drilling during 1925 failed to show any interesting sections of new ore.

Balance Sheet, Dec. 31, 1925

Assets		
Fixed		
Mines and mining claims	$1,558,915.78	
Buildings, machinery, plant and other assets	662,831.85	
		$2,221,747.63
Deferred		
Supplies and cyanide	$21,070.59	
Items in suspense, unearned taxes	29,337.58	50,408.17
Current		157,897.08
		$2,430,052.88
Liabilities		
Capital stock		
Authorized and issued		$2,400,000.00
240,000 shares, par value $10 each.		
Current		
Accounts payable		2,187.24
Surplus		
Deficit as at Dec. 31, 1924	$6,323.10	
Net earnings for year ended Dec. 31, 1925	34,188.74	27,865.64
		$2,430,052.88

Natomas Company of California

The annual report of the Natomas Company of California states that during 1925 14,399,689 cu.yd. of gravel was dredged, gold being recovered to the value of $1,397,337.30, at an operating cost, including taxes, insurance and rental, of $920,397.19, leaving an operating surplus of $476,940.11. Gross returns of the Natoma field averaged 9.84c. per cubic yard and operating costs were 6.17c. per cubic yard. Recoveries in the Natoma field averaged 23 per cent greater than the values indicated by prospecting.

At the beginning of 1925, seven dredges were in operation, two in the Feather River district and five in the Natoma district. On Jan. 17, 1925, Feather River dredge No. 3 was shut down and dismantled, and on Aug. 15, 1925, Feather River dredge No. 1 was closed down and sold to a group of former employees. On Jan. 29, 1925, Natoma dredge No. 10 was put in operation after having been dismantled and re-erected. At the close of the year six dredges were in operation.

Mining Stocks—Week Ended April 3, 1926

Stock	Exch.	High	Low	Last	Last	Div.
COPPER						
Anaconda	New York	44	41⅛	43⅞	Ap.17, My.24	0.75
Arcadian Consol.	Boston	*35	*25	*30		
Ariz. Com'l.	Boston	10⅜	9⅜	10⅛	Jy.21, Jy. 31 SA	0.50
Calaveras	N. Y. Curb			2⅛		
Calumet & Arizona	New York	58⅜	55⅛	58⅛	Mr.5, Mr.21 QX	1.50
Calumet & Hecla	Boston	14⅛	13⅝	14⅛	Nov.30, De.15 Q	0.50
Cerro de Pasco	New York	63	58	62⅛	Ja. 14, Fe. 1, Q	1.00
Chile Copper	New York	32⅝	31⅛	32⅛	Ma.3, Ma.29, Q	0.62½
Chino	New York	17⅞	17⅛	17⅞	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	1⅝	1⅝	1⅝		
Copper Range	Boston	16⅜	15⅛	16⅛	May, 1925	1.00
Crystal Copper	Boston Curb	*45	*43	*44		
East Butte	Boston	3½	3¼	3½	Dec., 1919	0.50
First National	Boston Curb	....	....	*15	Feb., 1919	0.15
Franklin	Boston			*50		
Granby Consol.	New York	17⅞	16½	17⅛	May, 1919	1.25
Greene-Cananea	New York	10⅛	10	10	Nov., 1920	0.50
Hancock	Boston	*50	*50	*50		
Howe Sound	New York	34	32	33⅛	Ap.1, Ap.15	0.75
Inspiration Consl.	New York	22⅞	20⅞	22⅛	Mar.18, Ap.5, Q	0.50
Iron Cap	Boston Curb	3⅛	3⅛	3⅛	May, 1923	0.15
Isle Royale	Boston	10⅛	10⅛	10⅛	No.30, De.5	1.00
Jerome Verde Dev.	N. Y. Curb	*75	*75	*75		
Kennecott	New York	52⅛	49⅞	51⅞	Ma.5, Ap.15 Q	1.00
Lake Copper	Boston	1⅛	1 1/16	1 1/16	June, 1925	0.50
Magma Copper	New York	39⅜	36⅜	39¼	Mh.31, Ap.15, Q	0.75
Mason Valley	N. Y. Curb	....	....	2		
Mass Consolidated	Boston	*40	*40	*40	Nov., 1917	1.00
Miami Copper	New York	12	11⅛	11⅞	My.1, My.15 Q	0.25
Mohawk	Boston	31⅛	30	31	Jan. 30, Ma.1 Q	1.00
Mother Lode Coa.	New York	6⅝	6⅛	6⅛	De. 11, De. 31	0.37½
Nevada Consol.	New York	12⅛	11⅞	12	Mh.18, Mh.31 Q	0.25
New Cornelia	Boston	19⅛	19	19⅛	Fe.5, Fe.23 Q	0.30
North Butte	Boston	2⅜	2⅛	2⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*51	*51	*50	No. 14, De. 2	0.05
Old Dominion	Boston	15⅛	14⅜	15⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†125	†120		Mar.20, Apr.20	1.00
Quincy	Boston	20	18⅜	19⅛	Mar., 1920	1.00
Ray Consolidated	New York	11⅜	11¼	11⅜	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	....	....	11⅞		
St. Mary's Min. Ld.	Boston	31	29	30⅛	May, 1925	3.00
Seneca Copper	New York	5⅜	5	5		
Shannon	Boston	*50	*50	*50	Nov., 1917	0.25
Superior & Boston	Boston	*55	*55	*55		
Tenn. C. & C.	New York	12⅛	10⅞	11⅜	Fe.27, Ma.15, Q	0.25
United Verde Ex.	N. Y. Curb	29	27⅛	28⅛	Ap.6, My.1,	0.75
Utah Copper	New York	93	93	93	Mh.18, Mh.31, Q	1.25
Utah Metal & T.	Boston	1⅞	1⅞	1⅞	Dec., 1917	0.30
Victoria	Boston	*50	*50	*50		
Walker Mining	Salt Lake	1.10	1.07½	1.07½		
NICKEL-COPPER						
Internat. Nickel	New York	35	32⅜	35	Ma.11, Ma.31, Q	0.50
Internat. Nickel, pfd.	New York	103	103	103	Ja.25, Fe.1, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*36½	*35	*36	Ja. 1, Ja. 10 M	0.0½
National Lead	New York	146	142	146	Ma.12, Ma.31 Q	2.00
National Lead pfd.	New York	116⅜	116⅜	116¾	Aug.21, Se.15	1.75
St. Joseph Lead	New York	40⅛	39	39¼	Jc.10, Je. 21 QX	0.75
ZINC						
Am. Z. L. & S.	New York	8⅛	7⅛	7⅛	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	30	26⅛	29⅜	Nov., 1920	1.50
Butte C. & Z	New York	5⅛	5	5	De.10, De.24	0.50
Butte & Superior	New York	12⅜	11	12⅛	Ma.15, Ma.31 Q	0.50
Callahan Zn-Ld	New York	2	1⅞	1⅞	Dec., 1920	0.50
Eagle Picher	Cincinnati	29¼	26⅛	29⅛	My. 15, Jn.1	0.40
Eagle Picher, pfd.	Cincinnati	...	...	110	Mh.31, Ap.15 Q	1.50
New Jersey Zn.	N. Y. Curb	...	...	208	Fe.10, Fe.28 Q	0.90
United Zinc	N. Y. Curb			*70		
Yellow Pine	Los Angeles	*30	*30	*30	De.8, De.18 Q	0.04
GOLD						
Alaska Juneau	New York	1⅝	1⅛	1⅝		
Argonaut	Toronto	*30	*28½	*29		
Barry-Hollinger	Toronto	*41	*38	*39		
Carson Hill	Boston	*35	*30	*30		
Consol. W. Dome L.	Toronto	*19	*18	*18		
Cresson Consol. G.	N. Y. Curb	2⅛	2⅛	2⅛	Mh.31, Ap 10	0.10
Crown Reserve	Toronto	*18½	*17½	*17½	Jan., 1917	0.05
Dome Mines	New York	16	15	16	Mh.31, Ap.20, Q	0.50
Golden Center	N. Y. Curb	1⅜	1	1⅜		
Golden Cycle	Colo. Springs	†1.50	†1.48½	....	No. 30, Dec.10 Q	0.03
Hollinger Consol.	Toronto	18.45	18.25	18.25	Ap. 6, Ap. 22,	0.08
Homestake Mining	New York	53½	53	53	Ma.20, Ma.25 M	0.50
Kirkland Lake	Toronto	1.01	*96	*97		
Lake Shore	Toronto	10.25	10.00	10.00	Ma.1, Ma.15 Q	0.10
McIntyre-Porcupine	New York	24	23½	24	Fe.1, Ma.7	0.05
Newray	Toronto	*35	*35	*35		
Night Hawk Pen	Toronto	*7	*6	*6		
Noranda	N. Y. Curb	13¼	12⅜	13		
Portland	Colo. Springs	†*56	†*54	....	Apr.6, Apr.15	0.02
Rand Mines	New York	....	....	34⅜	Fe.16, Fe.26	1.52
Teck-Hughes	Toronto	2.96	2.89	2.95	Ja. 15, Fe. 1	0.05
Tom Reed	Los Angeles	*75	*75	*75	Ma.10 Ma.20	0.02
Tough-Oakes	Toronto	*46½	*45½	*46		
United Eastern	N. Y. Curb	....	....	*45	July, 1924	0.05
Vipond Cons.	Toronto	1.58	1.54	1.56		
Wright-Hargreaves	Toronto	8.10	7.90	7.90	Mh.15, Ap.1	0.07½
Yukon-Alaska Trust	N. Y. Curb	....	....	21½		
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	18	18	18		
Con. Cortez	N. Y. Curb	*6	*6	*6		
Con. Virginia	San Francisco	*10½	*9½	*9½		
Continental Mines	N. Y. Curb	...	...	*45		
Dolores Esperanza	N. Y. Curb	*60	*50	*50	July, 1923	0.05
Premier Gold	N. Y. Curb	2½	2¼	2¼	Mh.19, Apr.3 Q	0.08
Tonopah Belmont	N. Y. Curb	3½	3	3¼	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	*70	*65	*66	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	5⅜	5	5⅜	Ap.7, Ap.21 Q	0.07½
Unity Gold	N. Y. Curb	...	...	*20		
West End Consol.	N. Y. Curb	...	...	*25	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*45	June, 1918	0.02

Stock	Exch.	High	Low	Last	Last	Div.
SILVER						
Alvarado	N. Y. Curb	....	....	1	Oct., 1920	0.50
Beaver Consol	Toronto	*71	*67½	*67½	May. 1920	0.03
Castle-Trethewey	Toronto	1.57	1.55	1.56		
Coniagas	Toronto			4.00	May, 1924	0.12½
Keeley	Toronto	1.57	1.54	1.56	Ma. 1, Ma. 15	X 0.12
Kerr Lake	N. Y. Curb	1¼	1	1⅛	Ap. 1, Ap. 15	0.12½
La Rose	Toronto	*16	*15	*15	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*85	*85	*85	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*18½	*18½	*18½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.60	3.50	3.53	Ja. 16, Ja. 30	0.12½
Nipissing	N. Y. Curb	6¼	6⅛	6⅛	Mh.31, Ap.20, Q	0.15
Temiskaming	Toronto	*13	*13	*13	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	8⅛	7¼	8⅛	Mh.8, Ap.5, Q	X 0.25
Alta Merger	Salt Lake	†*3	†*1			
Bingham Mines	Boston	47	42½	44½	Ma.20, Ma.31 Q	1.00
Cardiff M. & M.	Salt Lake			*55	De.16, No.18	0.10
Chief Consol	Salt Lake	3.30	3.27½	3.30	Fe. 1,	0.10
Emma Silver	Salt Lake	†*1	†*½			
Erupcion	Boston Curb	1⅛	1⅛	1⅛	Mh.18, Ap.5, X	0.10
Federal M. & S.	New York	84	80	84		
Federal M. & S., pfd.	New York	72	69	72	No.25, De.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*22	*18	*22		
Hecla Mining	N. Y. Curb	17⅛	17⅛	17⅛	Fe.15, Ma.15 Q	0.50
Iron King Mining	Salt Lake	.34	.33	34		
Keystone Mining	Salt Lake	*51	*49	*49	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*15⅞	*15¼	*15⅞		
Mammoth Mining	Salt Lake	....	....	2 80	Mar.24, Apr. 1	0.10
Marsh Mines	Spokane	*5½	*4⅝	*5¾	Se.15, Oc.1	0.15
Ontario Silver	New York			10		
Park Utah	Salt Lake	6.80	6.80	6.80	Mh.15, Ap.1	0.15
Prince Cons	Salt Lake	*4	*3½	*3½		
Silver King Coal	Salt Lake	8.05	7.85	7.85	Mh.20, Ap.1, Q	0.25
Silversmith	Spokane	*49	*47	*47	Apr. 1, Apr.10	0.02
Tamarack-Custer	Spokane	*52	*49	*52	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.00	12.62½	12.75	Mh.1, Mh.20, QX	0.40
Utah-Apex	Boston	9¼	8⅞	9	Apr. 9, Apr. 15	0.35
Western Utah Copper	N. Y. Curb	....	...	*8		
IRON						
Bethlehem Steel	New York	42⅛	40	41½	July, 1924	1.25
Colorado Fuel & Iron	New York	30⅜	27½	30¼	May, 1921	0.75
Gt. North'n Iron Ore	New York	24	21	23	De. 4, De. 28,	0.75
Inland Steel	New York	38⅛	37	38⅛	Fe.15, Ma.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅝	1⅜	1⅝		
Replogle Steel	New York	10⅜	9	10⅛		
Republic I. & S.	New York	51¼	45⅛	49⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	91⅜	91⅛	91⅜	Ma.15, Ap.1, Q	1.75
Sloss-Sheffield S. & I.	New York	111¼	105¼	111	Ma.10, Ma.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	....	....	102	Ma.20, Ap.1, Q	1.75
U. S. Steel	New York	123	117⅛	121⅞	Fe.27, Ma.3	X Q 1.75
U. S. Steel pfd.	New York	125⅞	125	125⅞	Fe. 3, Fe. 27, Q	1.75
Virginia I. C. & C.	New York	...	..	49½	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	...	...	73½	De.15, Ja.2,	2.50
VANADIUM						
Vanadium Corp.	New York	30⅛	29	30⅜	Fe.1, Fe.15, Q	0.50
ASBESTOS						
Asbestos Corp.	Montreal	90	89	89	De.31, Ja.15 Q	1.50
Asbestos Corp., pfd.	Montreal	114	113	113	De.31, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	24⅛	20⅛	23⅞	Nov., 1919	1.00
Texas Gulf	New York	132⅞	124⅛	130⅜	Ma.1, Ma.15, Q	2.50
DIAMONDS						
De Beers Consol.	New York	....	....	28⅛	Ja.26, Fe.2	0.23
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅜	4⅛	4⅜		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	50⅜	47	50⅜	Fe.18, Ma.1, Q	1.00
Amer. Metal pfd.	New York	115	115	115	Fe. 19, Ma. 1, Q	1.75
Amer. Sm. & Ref.	New York	119⅜	112⅛	117⅛	Ja.15, Fe.1,	1.75
Amer. Sm.&Ref.pfd.	New York	113⅞	112⅞	113¾	Fe.5, Ma.1, Q	1.75
Consol. M. & S.	N. Y. Curb	...	..	208	De.31, Ja.15	0.75
Federated Metals	N. Y. Curb	18	17	17		
Newmont Mining	N. Y. Curb	50	47½	49¾	Mar.31, Apr.15,	0.60
Southwest Metals	N. Y. Curb	...	...	2		
U. S. Sm. R. & M.	New York	43	39⅞	42⅞	Ap 8, Ap 15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	48⅞	48⅛	48⅞	Ap 8, Ap.15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED MARCH 23, 1926

Name	High	Low	Last	Last Divd. Date	Amount
Aramayo Mines (25 frs.)	82/6	80/—	80/—	Feb. 1926	5 p.c.†
British Platinum (£1)	6/—	5/—	5/6	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	16/6	15/9	16/1½	Feb. 1926	6 annas*
Bwana M'Kubwa (5s)	6/10½	6/4½	6/7½		
Camp Bird (£1)	5/6	5/4½	5/6		
El Oro (£1)	6/9	6/4½	6/9	Nov. 1924	2½ p.c.*
Esperanza (10s)	1/8	1/6	1/6		
Frontino & Bolivia (£1)	8/6	7/6	7/6	Jan. 1926	1½ p.c.
Mexican Corpn. (£1)	19/9	18/9	19/—		
Mexico Mines of El Oro (£1)	35/—	31/3	32/6	Dec. 1925	12½ p.c.*
Oroville Dredging (£1)	4/—	3/4½	3/6	Dec. 1923	3½ p.c.
Ouro Preto (£1)	2/6	2/—	2/6	May 1925	2½ p.c.
St. John del Rey (£1)	9/1½	8/3	9/—	June 1925	6½ p.c.
San Francisco Mines (10s)	29/4½	28/9	29/—	Jan. 1926	22½ p.c.
Santa Gertrudis (£1)	21/3	20/7½	20/9	July 1920	5 p.c.
Selukwe (2s. 6d.)	10/4½	9/6	9/9	April 1917	6¾ p.c.
S. Amer. Copper (2s.)	6/3	5/1½	5/3	Nov. 1917	75 p.c.
Tanganyika (£1)	45/10½	40/10½	41/10½	Sept. 1925	5 p.c.
Tomboy (£1)	3/3	3/—	3/—	Jan. 1926	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	6.250	6.050	6.200	July 1925	150 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.